TIMSS 2019

AUSTRALIA

VOLUME II

SCHOOL AND CLASSROOM CONTEXTS FOR LEARNING

Sue Thomson
Nicole Wernert
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Volume I and *TIMSS Australia 2019: Highlights* focus on the achievement results, detailing Australia's results within the international context, as well as the results for the Australian jurisdictions, and for different demographic groups within Australia.

Volume II presents the results from the contextual questionnaires and examines the home, school and classroom contexts in which learning and achievement occur, as well as student attitudes.

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EXECUTIVE SUMMARY

This is the second of two reports that look at the results of TIMSS 2019 and Australia's performance.

This report, Volume II, presents the results from the contextual questionnaires, and examines the home, school, and classroom contexts in which learning and achievement occur, as well as student attitudes.

Volume I focuses specifically on the achievement results, detailing Australia's results within the international context, and presents results for the Australian jurisdictions, and for the different demographic groups within Australia, including male and female students.

Each chapter focuses on different indicators that cover the school community, the school learning environment, mathematics and science teacher characteristics, mathematics and science classroom learning environments, and students' attitudes and beliefs. Together, the different indicators of student and school life illustrate some of the many key aspects that make up the school experience.

What is TIMSS?

The Trends in International Mathematics and Science Study (TIMSS) is an international comparative study of student achievement directed by the International Association for the Evaluation of Educational Achievement (IEA). TIMSS was first conducted in 1995 and the assessment conducted in 2019 formed the seventh cycle, providing 24 years of trends in mathematics and science achievement at Year 4 and Year 8. In Australia, TIMSS is managed by the Australian Council for Educational Research (ACER) and is jointly funded by the Australian Government and the state and territory governments.

The goal of TIMSS is to provide comparative information about educational achievement across countries in order to improve teaching and learning in mathematics and science. TIMSS is based on a research model that uses the curriculum, within context, as its foundation. TIMSS is designed, broadly, to align with the mathematics and science curricula used in the participating education systems and countries, and focuses on assessment at Year 4 and Year 8. TIMSS also provides important data about students' contexts for learning mathematics and science based on questionnaires completed by students and their parents, teachers and school principals.

In Australia, the results from TIMSS, as one of the assessments in the National Assessment Program, allow for nationally comparable reports of student outcomes against the *Alice Springs (Mparntwe) Education Declaration* (Council of Australian Governments Education Council, 2019).

Who is assessed?

TIMSS assesses a random sample of Year 4 and/or Year 8 students, drawn from a nationally representative sample of schools. Their principals and mathematics and science teachers are also asked to complete questionnaires.

In TIMSS 2019, 58 countries participated at Year 4 and 39 countries participated at Year 8. In total, over 580 000 students participated worldwide.

For comparability across countries and across assessments, testing was conducted at the end of the school year. Southern Hemisphere countries tested in the period from October to December 2018. The remaining countries tested at the end of the Northern Hemisphere school year, from May to June 2019.

In Australia, 287 primary schools and 284 secondary schools participated in the data collection for TIMSS 2019. From each school, at least one intact class from the relevant year level was selected, resulting in a sample of 5890 Year 4 students and 9060 Year 8 students. Australia took a larger sample than the one required by TIMSS in order to ensure that reliable estimates could be inferred for the states and territories.

What did TIMSS 2019 participants do?

As TIMSS focuses on international curricula in mathematics and science, a large number of test items, including both selected-response and constructed-response, were required to cover the range of topics and abilities. These items were grouped into blocks, which were then distributed across a number of assessment booklets.

Each participating student completed one of these booklets, which were evenly distributed within classes. This meant that only two or three students in each class completed each particular TIMSS booklet. After the assessment booklets were completed, students completed a questionnaire about their family background, aspects of their lives such as their motivation and engagement towards learning, and their attitudes to school.

Teachers, principals and curriculum experts also completed questionnaires, which enabled the collection of information about what is intended to be taught and about how it actually is taught in Australian classrooms.

The data from the Student, Teacher and Principal Questionnaires are described and analysed in this report.

How are the results reported?

International comparative studies provide an arena to observe the similarities and differences between educational policies and practices. They enable researchers and others to observe what it is possible for students to achieve and which environments are most likely to facilitate student learning.

In this report, information is provided about each of the variables for which results are presented, followed by the results for Australia as a whole, and the international averages for comparison. Then, for some variables, we provide percentages by geographic location and school socioeconomic composition (for school or classroom-level variables) or sex or student-level socioeconomic background (for student-level variables)

As TIMSS focuses on student outcomes, the results from the School Questionnaire and Teacher Questionnaire are presented with regard to students. That is, each result is reported as the percentage of students who attended a school that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way.

KEY FINDINGS

Composition of schools and school resources (Chapter 2)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 2 for detailed analysis.

- ▶ Year 4 and Year 8 students who attended *more affluent* schools had higher achievement in mathematics and science than students who attended *more disadvantaged* schools.
- ▶ A higher percentage of Year 4 and Year 8 students from schools in *regional and remote areas* than students from schools in *major cities* were at schools with a more disadvantaged student body.
- ▶ At Year 4, 48% of Australian students attended schools where more than 90% of students had English as their first language, compared to the international average of 63%. At Year 8, the percentage was 56% of Australian students, compared to the international average of 64%.
- ▶ 47% of Year 4 students attended schools where less than 25% of students *enter school with literacy and numeracy skills*. Those students recorded average mathematics and science scores around 30 points lower than the scores recorded by students who attended schools where at least 25% of the student population had literacy and numeracy skills upon entry to school.
- ▶ A higher percentage of students from *more disadvantaged* schools or from schools in *regional and remote areas* compared to students who attended *more affluent* schools or schools in *major cities* were at schools where less than 25% of students enter school with literacy and numeracy skills.
- ▶ At Year 4, 37% of students attended schools where science instruction was not affected by resource shortages compared to 63% of Year 8 students. After Singapore, with 75% of Year 8 students, Australia had the second highest percentage of Year 8 students who attended schools where science instruction was not affected by resource shortages.
- ▶ While there were no significant differences in achievement at Year 4, Year 8 students who attended schools where instruction was *not affected* by resource shortages achieved at a significantly higher level in mathematics and science than students who attended schools where instruction was *somewhat affected*.
- ▶ A higher percentage of students from *more disadvantaged* schools compared to students from *more affluent* schools were at schools where instruction was somewhat affected by resource shortages.
- ▶ At Year 4, 31% of Australian students attended schools with principals who had a postgraduate degree in educational leadership, compared to the international average of 36%. At Year 8, 50% of Australian students attended schools with a principal who had a postgraduate degree in educational leadership, compared to the international average of 39%.
- ▶ A higher percentage of Year 8 students from *more affluent* schools than students from *more disadvantaged* schools had principals who had a postgraduate degree in educational leadership but this difference was not seen for Year 4 students.

School climate, discipline and safety (Chapter 3)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 3 for detailed analysis.

- ▶ 9% of Year 4 students and 17% of Year 8 students attended schools whose principals reported a *very high* emphasis on academic success in their schools. These students had significantly higher average mathematics and science achievement than those from schools whose principals reported a *high* or *medium* emphasis on academic success.
- ▶ A higher percentage of students from *more affluent* schools than those from *more disadvantaged* schools had principals who reported a very high emphasis on academic success in their school.
- ▶ Year 4 and Year 8 students with a *high* sense of school belonging had higher achievement in mathematics and science than students with *little* sense of school belonging. This relationship was stronger at Year 8 than at Year 4.
- ▶ While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students at *more affluent* schools than those from *more disadvantaged* schools reported a high sense of school belonging.
- ▶ Students who attended schools whose principals reported *hardly any* problems with school discipline had higher achievement in mathematics and science than students from schools whose principals reported *moderate to severe* problems with school discipline.
- ▶ A higher percentage of students who attended *more affluent* schools than those from *more disadvantaged* schools had principals who reported hardly any problems with school discipline.
- ▶ Students with mathematics and science teachers who reported that their schools were *very safe and orderly* had higher achievement in mathematics and science than students whose teachers reported that their schools were *less than safe and orderly*.
- ▶ A higher percentage of students from *more affluent* schools than those from *more disadvantaged* schools had mathematics and science teachers who reported that their schools were very safe and orderly.
- ▶ 46% of Year 4 students and 36% of Year 8 students reported being bullied at least monthly. Students who *never or almost never* experienced bullying had higher achievement in mathematics and science than students who reported being bullied *about monthly* or *about weekly*.
- ▶ While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students from *more affluent* schools than those from *more disadvantaged* schools reported never being bullied.
- ▶ 7% of Year 4 students and 5% of Year 8 students reported being absent from school at least once a week. These students had significantly lower achievement in mathematics and science than students who reported never being absent (around 50% of students).
- ▶ While there were no significant differences between the socioeconomic groups at Year 8, a higher percentage of Year 4 students from *more disadvantaged* schools than those from *more affluent* schools were absent once a week.
- ▶ 34% of Year 4 students and 49% of Year 8 students reported coming to school feeling tired every day or almost every day. A higher percentage of Year 4 students from *more disadvantaged* schools than those from *more affluent* schools reported coming to school feeling tired every day or almost every day.
- ▶ 28% of Year 4 students and 27% of Year 8 students reported coming to school feeling hungry every day or almost every day. These students had significantly lower achievement than students who reported never coming to school feeling hungry (around 30% of students for both year levels).
- ▶ A higher percentage of students from *more disadvantaged* schools than those from *more affluent* schools reported coming to school feeling hungry every day or almost every day.

Mathematics teacher preparation, professional development and job satisfaction (Chapter 4)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 4 for detailed analysis.

- ▼ While almost all students were taught mathematics by teachers with at least a *bachelor degree or equivalent*, only 15% of Year 4 students and 22% of Year 8 students were taught by teachers with a *postgraduate university degree*, compared to 28% of Year 4 students and 35% of Year 8 students, on average, internationally.
- ▼ At Year 4, 80% of students were taught mathematics by teachers who *majored in primary education*, and a further 16% were taught mathematics by teachers who *majored in mathematics as well as primary education*.
- ▼ At Year 8, 77% of students were taught mathematics by teachers who majored in either or both mathematics and mathematics education, with the remaining 23% being taught by mathematics teachers who had not majored in either mathematics or mathematics education, and who could be considered to be teaching out-of-field.
- ▼ A higher percentage of Year 8 students from *more disadvantaged* schools than those in *more affluent* schools had mathematics teachers who had not majored in either mathematics or mathematics education.
- ▼ Mathematics teachers were asked about their need for future professional development opportunities in different topic areas. At both Year 4 and Year 8, the two most popular topics were *integrating technology into mathematics instruction* and *improving students' critical thinking or problem-solving skills*.
- ▼ At Year 4, 65% of students were taught by mathematics teachers who reported that they were *very satisfied* with their careers; whereas at Year 8, this percentage was 45%. There were no significant differences in mathematics achievement scores according to the level of teacher job satisfaction. However, at Year 8, students with teachers who reported they were *very satisfied* with their careers had significantly higher mathematics achievement scores than students whose teachers reported that they were *less than satisfied* with their careers.
- ▼ While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more affluent* schools than those who attended *more disadvantaged* schools had mathematics teachers who reported that they were very satisfied with their careers.
- ▼ While there were no significant differences according to the geographic location of schools at Year 4, a higher percentage of Year 8 students who attended schools in *regional and remote areas* than those who attended schools in *major cities* had mathematics teachers who reported that they were less than satisfied with their careers.

Teaching mathematics (Chapter 5)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 5 for detailed analysis.

- 74% of Year 4 students and 40% of Year 8 students reported *high clarity of instruction* in their mathematics lessons. These students had higher achievement in mathematics than those who reported *low clarity of instruction*.
- While there were no significant differences between socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more affluent* schools than those who attended *more disadvantaged* schools reported high clarity of instruction in their mathematics lessons.
- At Year 4, 71% of students had *computers available for use* in mathematics lessons, while in Year 8 the proportion was slightly larger at 76%. At Year 8, access to computers during mathematics lessons was associated with significantly higher achievement in mathematics than not having access.
- 17% of Year 4 students and 24% of Year 8 students reported disorderly behaviour in *most lessons*. Students who reported disorderly behaviour in *few or no lessons* had higher achievement in mathematics than students who reported disorderly behaviour in *most lessons*.
- While there were no significant differences between socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools reported disorderly behaviour in most lessons.
- Around 25% of Year 4 and Year 8 students were taught mathematics by teachers who reported that their teaching was limited *very little* by students not ready for instruction, with around 65% taught by mathematics teachers who reported that their teaching was limited *some*. Students whose mathematics teachers reported that their teaching was limited *very little* had higher achievement in mathematics than students whose mathematics teachers reported that their teaching was limited *a lot*.
- A higher percentage of Year 4 and Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools had mathematics teachers who reported that their teaching was limited a lot by students not ready for instruction.

Science teacher preparation, professional development and job satisfaction (Chapter 6)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 6 for detailed analysis.

- ▶ While almost all Australian Year 4 and Year 8 students were taught science by teachers with at least a *bachelor degree or equivalent*, only 16% of Year 4 students and 24% of Year 8 students were taught by teachers with a *postgraduate university degree*, compared to the international averages of 29% and 38%, respectively.
- ▶ At Year 4, 73% of students were taught science by teachers who *majored in primary education*, with a further 22% taught science by teachers who *majored in science as well as primary education*.
- ▶ At Year 8, 91% of students were taught science by teachers who *majored in either or both of science and science education*, with the remaining 9% being taught by science teachers who had *not majored in either science or science education*, and who could be considered to be teaching out-of-field.
- ▶ A higher percentage of Year 4 students from *more affluent* schools than students in *more disadvantaged* schools had science teachers who had majored in both science and primary education.
- ▶ Students' science teachers were asked about their need for future professional development opportunities in different topic areas. At both Year 4 and Year 8, the two most popular topics were *integrating technology into science instruction* and *improving students' critical thinking or inquiry skills*.
- ▶ At Year 4, 61% of students were taught by science teachers who reported that they were *very satisfied* with their careers; whereas at Year 8, this percentage was 55%. There were no significant differences in science achievement scores according to the level of job satisfaction reported by students' teachers for Australia at either year level.

Teaching science (Chapter 7)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 7 for detailed analysis.

- ▶ 68% of Year 4 students and 41% of Year 8 students reported *high clarity of instruction* in their science lessons. These students had higher achievement in science than students who reported *low clarity of instruction*.
- ▶ At Year 4, 78% of students had computers *available for use* in science lessons, while in Year 8 the proportion was slightly larger at 87%. At Year 8, access to computers during science lessons was associated with significantly higher achievement in science than not having access.
- ▶ 35% of Year 4 students and 14% of Year 8 students had science teachers who emphasised scientific investigation in *about half the lessons or more*. There was no relationship between the degree to which science teachers emphasised scientific investigation and the average science achievement for both year levels.
- ▶ Only 21% of Australian Year 4 students attended schools with science laboratories available for their use compared to the international average of 36%. At Year 8, 100% of Australian students attended schools with science laboratories available for their use compared to the international average of 85%. In Australia, there were no differences for Year 4 and Year 8 students in average science achievement according to the resources available for conducting science experiments.
- ▶ 13% of Year 4 students and 5% of Year 8 students *never* conducted experiments in their science lessons. Students who *never* conducted experiments in their science lessons had lower science achievement than those who conducted experiments at least *a few times a year*.
- ▶ A lower percentage of Year 8 students from *more affluent* schools never conducted experiments in their science lessons compared to students in *more disadvantaged* schools.
- ▶ Around 25% of Year 4 and Year 8 students were taught science by teachers who reported that their teaching was limited *very little* by students not ready for instruction, and around 70% of students were taught by science teachers who reported that their teaching was limited *some*. Students whose science teachers reported that their teaching was limited *very little* had higher achievement than students whose science teachers reported that their teaching was limited *a lot*.
- ▶ A higher percentage of Year 4 and Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools had science teachers who reported that their teaching was limited a lot by students not ready for instruction.

Student attitudes and aspirations (Chapter 8)

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made. Refer to Chapter 8 for detailed analysis.

- In general, students who indicated that they liked mathematics or science, were confident learning it and valued it, scored higher on average in the assessments than students who did not.
- Students generally showed quite negative attitudes towards mathematics, particularly at Year 8. Attitudes towards science were slightly less negative.
- 26% of Year 4 students and 50% of Year 8 students reported that they *do not like* learning mathematics, while 16% of Year 4 students and 28% of Year 8 students reported that they *do not like* learning science.
- 25% of Year 4 students and 44% of Year 8 students reported that they were *not confident* in mathematics, while 21% of Year 4 students and 45% of Year 8 students reported that they were *not confident* in science.
- Australian Year 8 students tended to value mathematics, with 86% valuing or strongly valuing mathematics (similar to the international average). However, levels of valuing science were lower, with 70% of Australian Year 8 students valuing or strongly valuing science, compared to the international average of 78%.
- On average, male students liked mathematics and science more than female students, they were more confident learning these subjects, and valued them more. However, female students who had the same level of confidence, liking or valuing of mathematics or science as male students scored at the same level, or higher than, their male peers.
- At Year 4, 35% of female students and 44% of male students reported that they *very much like* learning mathematics. At Year 8, this declined to just 10% of female students and 17% of male students. At the same time, at Year 4, 27% of female students and 25% of male students reported that they *do not like* learning mathematics, and by Year 8 this had increased to 57% of female students and 44% of male students.
- The differences between advantaged and disadvantaged students were quite stark. Disadvantaged students liked mathematics and science less, they were less confident and they valued mathematics and science to a lesser extent than did their advantaged peers.
- Female students held higher ambitions than male students, with a greater percentage aiming for university study. Students from advantaged backgrounds were far more likely to aspire to university than those from disadvantaged backgrounds, with the majority of those from disadvantaged backgrounds expecting that the completion of secondary school would be the highest education level they would achieve. The proportion of disadvantaged students aspiring to attend university has declined sharply since TIMSS 2015, from 16% to 8% of students.

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In Australia, TIMSS is managed by a team from the Australian Council for Educational Research (ACER) and guided by the International Assessments Joint National Advisory Committee (IAJNAC). ACER wishes to thank the IAJNAC members for their continued interest and commitment throughout every phase of the project. Their involvement included assisting with the implementation of TIMSS in schools in their jurisdictions, reviewing the report and providing valuable information to ensure the continued success of TIMSS in Australia.

The undertaking of TIMSS 2019 was a collaborative effort. A national survey such as TIMSS could not be successful without the cooperation of the school systems, principals, teachers, parents and, of course, the students. A high participation rate of the randomly selected schools and students is essential for the assessment to obtain high-quality data. It is thanks to this level of cooperation that Australia was able to satisfy the internationally set response criteria fully for TIMSS 2019. ACER gratefully acknowledges the assistance of education system officials Australia-wide, and the principals, teachers, parents and students in the participating schools who so generously gave their time and support in contributing to the project.

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READER'S GUIDE

Sample surveys

TIMSS is conducted as a sample survey in most countries. In a sample survey, a sample of students is selected to represent the population of students at a particular year level in a given country. The samples are designed and conducted so that they provide reliable estimates about their representative population. A sample survey is more economical for a school to undertake and less of a burden than a full census of the particular population.

The sample design for TIMSS is known as 'a two-stage stratified cluster sample design'. Stage 1 samples the schools and Stage 2 identifies a single mathematics classroom selected at random from the target year level in the chosen sampled schools.

Statistical weights are used to adjust for any differences arising from intended features of the design (e.g. to over-sample minorities) or non-participation by students who were selected. In this way we can provide measures of achievement for the population, based on the responses of a sample. Please refer to the international TIMSS website for more information about sampling in TIMSS.

TIMSS achievement scales

TIMSS 2019 used item response theory (IRT) methods to summarise the achievement of students on a scale with a mean of 500 and a standard deviation of 100 (refer to the international TIMSS website for more information about IRT methods).

It should be noted that the results for Year 4 and Year 8 should not be compared, nor should the results for mathematics and science at a particular year level. While the scales are expressed in the same numerical units, they are not directly comparable such that conclusions could be drawn about how much learning in mathematics equals how much learning in science (or how much learning at Year 4 equals how much learning at Year 8). That is, achievement on the TIMSS scales cannot be described in absolute terms (like all such scales developed using IRT technology). Comparisons can be made only in terms of relative performance (higher or lower), for example, among countries and population groups, as well as over time.

The TIMSS mathematics and science scales for Year 4 and Year 8 were based on those established in the first cycle of the study (TIMSS 1995) and the methodology enables comparable trend measures from assessment to assessment within each year level (refer to the international TIMSS website for more information).

TIMSS context questionnaire scales

Many of the TIMSS 2019 context questionnaire items were developed to be combined into scales that measure a single underlying construct or characteristic (e.g. school emphasis on academic success; confidence in learning mathematics).

For reporting, the scales were constructed using item response theory (IRT) scaling methods. Data from selected context questionnaire responses were placed on a scale constructed with a mean of 10 and a standard deviation of 2 (refer to the international TIMSS website for more information about the creation of these scales).

Students were then able to be classified into groups that corresponded to high, middle, and low values on each construct. To enable interpretation of the groups, the cut-points on the scale defining the groups were described in terms of combinations of response categories (e.g. Year 4 students classified as “very much liking mathematics” are those with a scale score greater than or equal to a cut-point defined for the scale, 10.2 in this case, corresponding to “agreeing a lot” with five of nine statements and “agreeing a little” with the other four statements, on average). The definitions of the groups are included for each context scale at the start of the section that describes the findings for that scale.

Standard errors and confidence intervals

In this and other reports, student achievement is often described by a mean or average score. For TIMSS, each mean score is calculated from the sample of students who undertook the assessments. These sample means are an approximation of the actual mean score (known as the population mean) that would have been derived had all students in Australia participated in the TIMSS assessment.

If another sample of students was chosen on a different day, it is highly likely that the sample mean would be slightly different. Indeed, the sample mean is just one point along the range of student achievement scores, and so more information is needed to gauge whether the sample mean is an underestimation or overestimation of the population mean. This is also the case for estimations of percentages of students with certain characteristics.

In this report, means and percentages are presented with an associated *standard error*. The standard error is a measure of the accuracy of the estimate of the population mean or percentage from the sample. The size of the sample, as well as the variance or spread of the scores within the sample, can affect the size of the standard error. Smaller samples, or samples with a greater spread in scores, will have larger standard errors.

The calculation of confidence intervals can assist our assessment of a sample mean or percentage precision as an estimate of the population mean or percentage. Confidence intervals provide a range of scores within which we are ‘confident’ that the population mean actually lies. The confidence interval is within plus or minus 1.96 standard errors of the sample mean or percentage. A larger standard error results in a larger confidence interval, and a greater likelihood that the confidence intervals of two means or percentages will overlap and, therefore, reduce any difference to non-significance (see the next section on statistical significance).

Statistical significance

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

Rounding of figures

Due to rounding to eliminate decimals, some percentages in tables and figures may not exactly add to the totals. 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 decimal place and the value 0.0 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05.

Correlational analysis

An analysis of the correlation between two variables can be used to investigate the association between them. If there is a significant positive correlation, it does not imply that one factor depends on the other or that there is a cause-effect relationship between them – it simply means that they occur together. Further analysis and investigation are needed to determine the nature of the association.

The most commonly used measure is the Pearson correlation coefficient, which is abbreviated as *r*. The correlation coefficient measures the strength between two variables. Values of the correlation coefficient can range from -1 (a negative correlation – as one value increases the other value decreases) to a $+1$ (a positive correlation – as one value increases the other value increases).

In this report, as a general rule, correlation coefficients between 0.10 and 0.29 represent a small association, correlation coefficients between 0.30 and 0.49 represent a moderate association, and correlation coefficients of 0.50 and above represent a strong association.

Students as the unit of analysis

As TIMSS focuses on student outcomes, the results from the School and Teacher Questionnaires are presented with regard to students. That is, each result is reported as the percentage of students who attended schools that had certain characteristics or as the percentage of students taught by teachers who responded in a particular way. This is due to the fact that the sample for TIMSS is designed to be representative of the student population, not the teacher or school population.

When reporting results from the Teacher Questionnaire, results are reported separately for mathematics and science teachers. At Year 4, the results were very similar, as most Year 4 students have the same classroom teacher for both mathematics and science.

International comparisons

TIMSS compares results to ‘all countries, on average’ or to the *international average* or to individual countries – most often other English-speaking countries and high-performing countries (such as Singapore), or the countries that had notable results for that variable.

The *international average* refers to the mean score or percentage of all countries for which we have data on that variable from those who participated in TIMSS 2019 at that year level.

Notes about participating countries

A number of countries have official names that are longer than those by which they are usually designated in conversation. In order to facilitate the reading of the TIMSS reports, these countries are referred to by their shortened form in the text (e.g. Hong Kong, Korea, Iran), rather than their official name (e.g. Hong Kong SAR; Korea, Republic of; Iran, Islamic Republic of).

Some countries choose to administer TIMSS to grades different to the fourth or eighth years of formal schooling. Norway chose to assess the fifth and ninth grades to obtain better comparisons with Sweden and Finland. South Africa assessed the fifth and ninth grades to better suit their curricula and to maintain trend measurement. Turkey also chose to assess students in the fifth grade.

Definitions of background characteristics

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

Number of books in the home

This variable is used as a proxy for socioeconomic status, where information about parents' occupations, education and wealth are not available. It is derived from student self-reports of the number of books in their homes. Their responses have been grouped so that a *few books* equals 25 or fewer books, an *average number of books* equals between 26 and 200 books and *many books* equals more than 200 books. While the relationship between the number of books in the home and student achievement is not definitive, there is a very strong relationship between the two.

Number of books in the home is used for student-level socioeconomic background for Year 4 students.

Educational resources in the home

The presence or absence of educational resources in the home expresses potential advantage or disadvantage for students, which may reflect parents' ability to provide materially for their children or indicate differences in practical and psychological support for academic achievement. These resources may be physical, such as books or an internet connection, or take the form of more intangible attributes such as parental education or occupation.

The Home Educational Resources scale was created using Year 8 students' responses to three items:

- ▶ parents' educational background
- ▶ number of books in the home
- ▶ home study supports – students having their own room and an internet connection at home.

Students with *many resources* had a score on the scale of at least 12.2, which corresponded to their reporting that they had more than 100 books in the home along with both home study supports (own room and an internet connection), and that at least one of their parents had finished university, on average. In contrast, students with *few resources* had a scale score no higher than 8.4, which corresponded to their reporting that they had 25 or fewer books in the home, that they had neither their own room nor an internet connection, and that neither of their parents had proceeded beyond upper secondary school, on average. All other students were classified as having *some resources*.

Please note that as Australia did not ask parents to complete the Early Learning Survey, information about parental education, and therefore the Home Resources for Learning scale, is not available for Year 4 students.

The Home Educational Resources scale is used for student-level socioeconomic background for Year 8 students.

Geographic location of the schools

For Australia's participation in TIMSS 2019, participating schools were coded using the *Australian Bureau of Statistics' Australian Statistical Geography Standard (ASGS) Remoteness Structure*, (ABS, 2011), which has superseded the MCEETYA classification of geographic location, used in previous cycles of TIMSS (see Volume I for more information about the MCEETYA classification of geographic location).

The following categories were used to report geographic location using the ASGS Remoteness Structure:

- ▶ *major cities*, which includes all major cities of Australia
- ▶ *regional areas*, which includes all inner regional and outer regional areas in Australia
- ▶ *remote areas*, which includes all remote and very remote areas in Australia.

In this report, *regional areas* and *remote areas* have been combined into one category due to the large standard errors attached to schools in remote areas.

Teacher education

One path to becoming a qualified teacher in Australia is to complete a graduate diploma in education, after completion of an undergraduate degree. For the purposes of this report, given that the graduate diploma is necessary for teacher accreditation, the graduate diploma has been included in the same category as the bachelor's degree or equivalent. Please note that this was not the case in TIMSS 2011 (when the graduate diploma was included as a postgraduate degree). Accordingly, responses to the teacher-education variable in cycles from TIMSS 2015 onwards cannot be compared with cycles from TIMSS 2011 and earlier.

CHAPTER 1

INTRODUCTION

1.1 What is TIMSS?

The Trends in International Mathematics and Science Study (TIMSS) is an international study that assesses the mathematical and scientific knowledge and understanding of Year 4 and Year 8 students. TIMSS is directed by the International Association for the Evaluation of Educational Achievement (IEA), an independent international cooperative of national research institutions and government agencies that has been conducting studies of cross-national achievement in a wide range of subjects since 1959.

Australia has participated in TIMSS since the first cycle in 1995 and in every four-year cycle since then and now has a breadth and depth of rich data about trends in mathematics and science achievement over a 24-year period.

To inform educational policy in participating countries, TIMSS also routinely collects extensive background information that addresses concerns about the quantity, quality and content of instruction. This background information is collected through a series of questionnaires for students, parents, teachers, principals and curriculum specialists.

Australia was one of 64 countries, and eight regions or benchmarking participants,¹ that participated in TIMSS 2019 involving around 6000 Year 4 students and 9000 Year 8 students. These students completed the tests in mathematics and science and answered questionnaires on their background and experiences in learning these subjects at school. School principals and the students' mathematics and science teachers also completed detailed questionnaires.

TIMSS 2019 was managed by the TIMSS & PIRLS International Study Center, Lynch School of Education, at Boston College in the United States. Sampling procedures were overseen by Statistics Canada and the Sampling Unit at IEA Hamburg. The IEA Secretariat and the TIMSS & PIRLS International Study Center oversaw the translation and verification processes as well as the quality-assurance program; and IEA Hamburg was responsible for oversight of the data collection, data processing and data analysis.

Appendix A of Volume I provides more information about the operations and procedures involved in TIMSS 2019.

¹ A benchmarking participant is a province or region that participated in TIMSS for its own internal benchmarking. Data from these provinces are not included in the international averages or medians and are not included in this national report.

1.2 What are the main goals of TIMSS?

The main goal of TIMSS is to assist countries to monitor and evaluate their mathematics and science teaching across time and across year levels. TIMSS offers countries an opportunity to:

- ▶ collect comprehensive and internationally comparable data about the mathematics and science concepts, processes and attitudes that students have learnt by Year 4 and Year 8
- ▶ assess progress internationally in mathematics and science learning across time for students in Year 4 and for students in Year 8
- ▶ examine changes over time within a cohort of students, given that the cohort of Year 4 students in one cycle is assessed again as Year 8 students in the next cycle
- ▶ understand the contexts in which students learn best since TIMSS enables international comparisons of the key policy variables in relation to school curricula, modes of instruction and provision of resources that result in higher levels of student achievement
- ▶ use TIMSS to address internal policy issues – for example, within countries TIMSS provides an opportunity to examine the performance of population subgroups and address equity concerns.

1.3 Research model for IEA studies

TIMSS is based on a research model that uses the curriculum, in broad terms, as its foundation. The TIMSS curriculum model includes three curriculum levels, considered in relation to the context in which they occur. These levels are shown in Figure 1.1.

FIGURE 1.1 The TIMSS curriculum model

The research questions associated with each of the curriculum levels are:

- ▶ The *intended* curriculum – defined as the curriculum as specified at national or system level. *What are mathematics and science students around the world expected to learn? How do countries vary in their intended goals, and what characteristics of education systems, schools and students influence the development of these goals? How should the education system be organised to facilitate this learning?*
- ▶ The *implemented* curriculum – defined as the curriculum as interpreted and delivered by classroom teachers. *What is actually taught in classrooms? Who teaches it? What opportunities are provided for students to learn mathematics and science? How do instructional practices vary among countries and what factors influence these variations?*

- The *attained* curriculum – defined as the part of the curriculum that is learnt by students, as demonstrated by their attitudes and achievements. *What mathematics and science concepts, processes and attitudes have students learnt? What factors are linked to students' opportunity to learn, and how do these factors influence students' achievements?*

The data describing the intended curriculum were gathered through the Curriculum Questionnaire, which asked about the mathematics and science curricula, school organisational approaches and instructional practices. The response to this extensive questionnaire was developed in Australia by the Australian Council for Educational Research, reviewed by curriculum experts in each state and territory education department, and then submitted to the International Study Center. Further information about the curriculum and education policies is available through the TIMSS 2019 Encyclopedia.

1.4 What was required of Australian students?

In Australia, students who participated in TIMSS 2019 completed an assessment booklet that contained an even distribution of mathematics and science items. The booklets were designed to be administered in two sessions, separated by a short break. Each session was of 36 minutes' duration at Year 4 and 45 minutes' duration at Year 8. In addition to completing the assessment booklet, each student completed a Student Questionnaire.

The context questionnaires

Central to the TIMSS research model is the idea that it is important to understand the contexts in which students learn, as well as to assess achievement. After the achievement data were collected from students, each student completed a Student Questionnaire. Teacher and School Questionnaires were also administered to the mathematics and science teacher(s) of each selected class and to the principal of the school.

The Student Questionnaire sought information on home contexts, and on students' characteristics and attitudes towards learning mathematics and science.

The Teacher Questionnaire asked about teacher preparation and experience, pedagogical practices, use of technology, assessment, assignment of homework, school and classroom climate, and whether the TIMSS topics had been covered in class.

The School Questionnaire, answered by the principal (or the principal's designate), sought descriptive information about school characteristics, instructional time, resources and technology, school climate for learning, students' school readiness, and principal preparation and experience.

1.5 Who participated in TIMSS 2019?

Internationally

A total of 58 countries at Year 4 (30 of which undertook eTIMSS) and 39 countries at Year 8 (22 of which undertook eTIMSS) participated in TIMSS 2019, along with the eight benchmarking participants. In total, over 580 000 students were involved worldwide. The participating countries are shown in Table 1.1.

TABLE 1.1 Countries that participated in TIMSS 2019

Participating countries			
eTIMSS		Paper-based TIMSS	
Austria*	Korea	Albania*	Kuwait
Canada*	Lithuania	Armenia*	Latvia*
Chile	Malaysia [†]	Australia	Lebanon [†]
Chinese Taipei	Malta*	Azerbaijan*	Montenegro*
Croatia*	Netherlands*	Bahrain	Morocco
Czech Republic*	Norway	Belgium (Flemish)*	New Zealand
Denmark*	Portugal	Bosnia and Herzegovina*	North Macedonia*
England	Qatar	Bulgaria*	Northern Ireland*
Finland	Russian Federation	Cyprus	Oman
France	Singapore	Egypt [†]	Pakistan*
Georgia	Slovak Republic*	Iran	Philippines*
Germany*	Spain*	Ireland	Poland*
Hong Kong	Sweden	Japan	Romania [†]
Hungary	Turkey	Jordan [†]	Saudi Arabia
Israel [†]	United Arab Emirates	Kazakhstan	Serbia*
Italy	United States	Kosovo*	South Africa
Benchmarking participants			
Ontario, Canada	Madrid, Spain	Gauteng, South Africa [†]	
Quebec, Canada	Abu Dhabi, UAE	Western Cape, South Africa [†]	
Moscow City, Russian Fed.*	Dubai, UAE		

* Country participated at Year 4 only. See the Reader's Guide for more information.

[†] Country participated at Year 8 only. See the Reader's Guide for more information.

Testing period

For comparability across countries and across assessments, testing was conducted at the end of the school year. Southern Hemisphere countries tested in the period from October to December 2018. The remaining countries tested at the end of the Northern Hemisphere school year, from May to June 2019.

Within Australia

The international sample design for TIMSS is generally referred to as 'a two-stage stratified cluster sample design'. Stage 1 samples schools, which in Australia are stratified by jurisdiction,² sector, geographic location and a socioeconomic variable. The intention is that the sample drawn will be representative of each of these strata. Stage 2 samples one or two intact classrooms from the target year in sampled schools.

In most countries, 150 schools and one classroom in each school (resulting in at least 4000 participating students per country) were selected to participate. In some countries, including Australia, a larger sample of schools and students participated in order to allow for meaningful comparisons to be made between different sections of the school population. This enabled the production of reliable estimates for each of the Australian jurisdictions.

² In this report, the Australian states and territories are referred to collectively as the 'jurisdictions'.

In Australia, 287 primary schools and 284 secondary schools participated in the TIMSS 2019 data collection. At least one intact class from the relevant year level from each school was selected, resulting in a sample of 5890 Year 4 students and 9060 Year 8 students. For more information about sampling and the Australian TIMSS sample, please refer to Appendix A of Volume I.

Statistical weighting enables the sampled students to represent the total student population at each year level (for more information about weighting, please refer to the Reader's Guide). The weighted numbers for Australia for Year 4 and Year 8, along with the numbers of participating schools and students, are shown in Table 1.2.³

TABLE 1.2 Australian designed and achieved school and student sample, Year 4 and Year 8

Year 4	Designed school sample	N schools	N students	Weighted N students	Weighted % of total Australian students
ACT	29	29	563	5308	1.8
NSW	46	46	985	94033	31.1
VIC	45	44	858	75861	25.1
QLD	45	45	1037	66820	22.1
SA	41	41	820	19677	6.5
WA	39	38	852	31677	10.5
TAS	31	30	540	6460	2.1
NT	14	14	235	2737	0.9
<i>Australia</i>	<i>290</i>	<i>287</i>	<i>5890</i>	<i>302574</i>	<i>100.0</i>
Year 8	Designed school sample	N schools	N students	Weighted N students	Weighted % of total Australian students
ACT	30	30	973	5128	1.9
NSW	45	45	1791	90126	32.6
VIC	45	45	1307	69738	25.3
QLD	47	47	1672	57734	20.9
SA	40	39	994	17789	6.4
WA	37	37	1491	28170	10.2
TAS	30	28	529	5478	2.0
NT	15	13	303	1888	0.7
<i>Australia</i>	<i>289</i>	<i>284</i>	<i>9060</i>	<i>276051</i>	<i>100.0</i>

Due to differences between the jurisdictions in school starting ages, the average age of students at the time of testing varied across jurisdictions, ranging from 9.9 years in Queensland, Western Australia and the Northern Territory to 10.4 years in Tasmania at Year 4, and from 13.9 years in Queensland and Western Australia to 14.4 years in Tasmania at Year 8 (Table 1.3).

³ Sample numbers are weighted by jurisdiction in order to indicate the proportional distribution across each of the eight jurisdictions of the total Australian population of Year 4 and Year 8 students.

TABLE 1.3 Average age for Year 4 and Year 8 students, Australia and by jurisdiction

	ACT	NSW	VIC	QLD	SA	WA	TAS	NT	AUS
Year 4	10.1	10.1	10.2	9.9	10.1	9.9	10.4	9.9	10.1
Year 8	14.1	14.1	14.3	13.9	14.1	13.9	14.4	14.0	14.1

Internationally, the average age of students who participated in the Grade 4 cohort varied from 9.6 years in Italy to 11.5 years in South Africa. The average age of students in Year 8 varied from 13.7 years in Italy and the United Arab Emirates to 15.5 years in South Africa. For more information about the age of participating students, please refer to Methods and Procedures in TIMSS 2019.

1.6 TIMSS and Australia's National Assessment Program

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

Results from these NAP assessments allow for nationally comparable reporting of progress towards the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008) and the *Alice Springs (Mparntwe) Education Declaration* (Education Council, 2019). These declarations set out a vision for education in Australia that promotes excellence and equity to enable all Australians to become confident and creative individuals, successful learners, and active and informed community members.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) reports on the NAP assessments annually in its *National Report on Schooling in Australia*, which is the main vehicle for reporting against nationally agreed key performance measures defined in the *Measurement Framework for Schooling in Australia 2019* (ACARA, 2019).

1.7 Organisation of the report

This is the second of two reports that look at the results of TIMSS 2019 and Australia's performance. Volume I focuses specifically on the achievement results, detailing Australia's results within the international context, and presents the results for the Australian jurisdictions and for different demographic groups within Australia, including male and female students. It also examines TIMSS 2019 results in the content and cognitive domains.

This report, Volume II, presents the results from the contextual questionnaires and examines the home, school, and classroom contexts in which learning and achievement occur, as well as student attitudes.

Each chapter focuses on different indicators that cover the school community, the school learning environment, mathematics and science teacher characteristics, mathematics and science classroom learning environments, and students' attitudes and beliefs. Together, the different indicators of student and school life illustrate some of the many key aspects that make up the school experience.

In each chapter, information is provided about each of the variables for which results are presented, followed by the results for Australia as a whole, and the international average for comparison. Then, for some variables, we provide percentages by geographic location and school socioeconomic composition (for school or classroom-level variables) or sex or student-level socioeconomic background (for student-level variables).

Many variables presented in this report are scales that are created from the combination of a number of context questionnaire items to represent a single underlying construct (refer to the Reader's Guide for more information about these scales). Students were classified into groups corresponding to high, middle, and low values on the construct. These groups are described at the start of the section, followed by the percentages of students in each group and their mean achievement.

Please note that as TIMSS focuses on student outcomes, results from the Teacher Questionnaire, School Questionnaire and Student Questionnaire are all presented with regard to students. This means that each result is reported as the percentage of students who attended schools that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way.

Finally, results in this Volume II report that are presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Appendices at the end of this report.

CHAPTER 2

COMPOSITION OF SCHOOLS AND SCHOOL RESOURCES

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- ▶ Year 4 and Year 8 students who attended *more affluent* schools had higher achievement in mathematics and science than students who attended *more disadvantaged* schools.
- ▶ A higher percentage of Year 4 and Year 8 students from schools in *regional and remote areas* than students from schools in *major cities* were at schools with a more disadvantaged student body.
- ▶ At Year 4, 48% of Australian students attended schools where more than 90% of students had English as their first language, compared to the international average of 63%. At Year 8, the percentage was 56% of Australian students, compared to the international average of 64%.
- ▶ 47% of Year 4 students attended schools where less than 25% of students *enter school with literacy and numeracy skills*. Those students recorded average mathematics and science scores around 30 points lower than the scores recorded by students who attended schools where at least 25% of the student population had literacy and numeracy skills upon entry to school.
- ▶ A higher percentage of students from *more disadvantaged* schools or from schools in *regional and remote areas* compared to students who attended *more affluent* schools or schools in *major cities* were at schools where less than 25% of students enter school with literacy and numeracy skills.
- ▶ At Year 4, 37% of students attended schools where science instruction was not affected by resource shortages compared to 63% of Year 8 students. After Singapore, with 75% of Year 8 students, Australia had the second highest percentage of Year 8 students who attended schools where science instruction was not affected by resource shortages.
- ▶ While there were no significant differences in achievement at Year 4, Year 8 students who attended schools where instruction was *not affected* by resource shortages achieved at a significantly higher level in mathematics and science than students who attended schools where instruction was *somewhat affected*.
- ▶ A higher percentage of students from *more disadvantaged* schools compared to students from *more affluent* schools were at schools where instruction was somewhat affected by resource shortages.
- ▶ At Year 4, 31% of Australian students attended schools with principals who had a postgraduate degree in educational leadership, compared to the international average of 36%. At Year 8, 50% of Australian students attended schools with a principal who had a postgraduate degree in educational leadership, compared to the international average of 39%.
- ▶ A higher percentage of Year 8 students from *more affluent* schools than students from *more disadvantaged* schools had principals who had a postgraduate degree in educational leadership but this difference was not seen for Year 4 students.

The environment in which students learn can help or hinder their achievement. At a basic level, a lack of resources, such as adequate facilities, appropriately qualified staff and sufficient instructional resources, is going to make teaching and learning more difficult (Hanushek & Wößmann, 2017). Schools with greater proportions of students from groups that are considered educationally disadvantaged will also stretch resources and make teaching and learning more difficult (Martin et al., 2013).

More broadly, the social-emotional environment (that is, the way the members of the school community experience the school) will have an impact on teaching and learning (Greenberg, 2004; Martin et al., 2013). Factors such as the emphasis on academic success within the school community, the school disciplinary climate, and student behaviour have all been found to influence student achievement (Greenberg, 2004).

Chapters 2 and 3 of this report present Australian data on the characteristics of schools and school environments. This chapter draws on data collected in the TIMSS School Questionnaire and focuses on the student body composition (such as socioeconomic and language background) and school resources, including principals' qualifications.

As TIMSS focuses on student outcomes, results from the Teacher Questionnaire and the School Questionnaire are presented with regard to students. This means that each result is either reported as the percentage of students who attended schools that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 2 section of the Appendices.

2.1 School socioeconomic composition

The socioeconomic composition of schools has an effect on student achievement (e.g. Liu et al., 2015). Accordingly, the TIMSS 2019 School Questionnaire asked school principals to report on the socioeconomic composition of their schools by indicating the percentages of students who came from economically affluent homes and from economically disadvantaged homes. The responses to these questions were then used to create three categories of school socioeconomic composition:

- ▶ *more affluent* – schools where more than 25% of the student body comes from economically affluent homes and not more than 25% from economically disadvantaged homes
- ▶ *more disadvantaged* – schools where more than 25% of the student body comes from economically disadvantaged homes and not more than 25% from economically affluent homes
- ▶ *neither more affluent nor more disadvantaged* – all other response combinations.

This variable has been used in this report to investigate whether other variables of interest vary by the degree to which a school's student body is relatively more affluent or more disadvantaged.

Figure 2.1 presents the proportions of students in each of the socioeconomic composition categories, along with their average mathematics and science scores.

Note: Due to rounding, totals may not add to 100%.

FIGURE 2.1 Socioeconomic composition of schools and student achievement in mathematics and science, Australia and the international averages

At Year 4, 34% of Australian students attended *more affluent* schools; 38% attended schools that were *neither more affluent nor more disadvantaged*; and 28% attended schools where the economic background of the student body was *more disadvantaged*. Internationally, on average, 41% of Year 4 students attended *more affluent* schools, 34% attended schools that were *neither more affluent nor more disadvantaged* and 25% attended schools that were *more disadvantaged*.

At Year 8, 39% of Australian students attended *more affluent* schools; 34% attended schools that were *neither more affluent nor more disadvantaged*; and 27% attended schools where the economic background of the student body was *more disadvantaged*. Internationally, on average, 35% of Year 8 students attended *more affluent* schools, 33% attended schools that were *neither more affluent nor more disadvantaged* and 32% attended schools that were *more disadvantaged*.

As can be seen in Figure 2.1, there is a clear relationship between the composition of the student body and student achievement for mathematics and science at both Year 4 and Year 8 (a correlation of around 0.25 at Year 4 and around 0.36 at Year 8). A substantial gap was recorded between students who attended schools with a *more affluent* student body and those who attended schools with a *more disadvantaged* student body. This gap amounted to 57 points for Year 4 mathematics; 85 points for Year 8 mathematics; 53 points for Year 4 science; and 78 points for Year 8 science. Internationally, on average, the gap was around 42–45 points at Year 4 and 50–52 points at Year 8, for both mathematics and science.

Geolocation differences

In Australia, the locations of schools (in *major cities* or in *regional and remote areas*) relate to differences in achievement (see Volume I). These may be due to the characteristics of schools or classrooms. In Volume II, we also investigate whether certain variables of interest change depending on the geographic location of the school. Please see the Reader's Guide for more information about this variable.

Figure 2.2 presents the proportions of Australian students who attended schools of different socioeconomic composition according to the location of the school (the two categories are *major cities*, and *regional and remote areas*). In Australia, there are differences in schools' socioeconomic composition according to the geographic location of the school. That is, a higher percentage of students at schools in *regional and remote areas* than students at schools in *major cities* were at schools with a more disadvantaged student body.

At Year 4, 37% of students who attended schools in Australia's *major cities* had principals who reported their schools had more affluent student bodies and 24% attended schools whose principals reported their schools had more disadvantaged student bodies. In comparison, 24% of students who attended schools in *regional and remote areas* had a principals who reported their schools had more affluent student bodies and 41% attended schools whose principals reported their schools had more disadvantaged student bodies. Only the difference in the percentage of students who attended schools with a more disadvantaged student body was significant.

There were similar patterns for Year 8 students where 47% of students attended schools in *major cities* whose principals reported their schools had more affluent student bodies compared to 20% of students in schools in *regional and remote areas*. Twenty-one per cent of students in schools in *major cities* had principals who reported their schools' student bodies were more disadvantaged compared to 43% of students in *regional and remote areas*. Both of these differences were significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 2.2 Socioeconomic composition of schools, in Australia, by school geographic location

2.2 Language background of school populations

When a student body is composed predominantly of students who do not have the language of instruction as a native language, educational and cultural complexities may challenge schools and teachers. The TIMSS 2019 School Questionnaire asked Australian principals what proportion of their student bodies had English as their first language.

Figure 2.3 presents the proportions of students in each of three response categories, along with their average mathematics and science scores.

At Year 4, 48% of Australian students attended schools where more than 90% of students had English as their first language; 34% attended schools where 51–90% of students had English as their first language; and 17% attended schools where 50% or less of students had English as their first language. In comparison, the international averages were 63% of students attended schools where more than 90% of students had the language of the test as their native language; 18% attended schools where 51–90% of students had the language of the test; and 19% attended schools where 50% or less of students had the language of the test.

At Year 8, 56% of Australian students attended schools where more than 90% of students had English as their first language; 31% attended schools where 51–90% of students had English as their first language; and 13% attended schools where 50% or less of students had English as their first language. In comparison, the international averages were 64% of students attended schools where more than 90% of students had the language of the test as their native language; 17% attended schools where 51–90% of students had the language of the test; and 18% attended schools where 50% or less of students had the language of the test.

Note: Due to rounding, totals may not add to 100%.

FIGURE 2.3 Language background of schools' populations and student achievement in mathematics and science, Australia and the international averages

In Australia, there were no significant differences in average achievement according to the language background of the student body, except for Year 8 mathematics. In this case, students who attended schools where 50% or less of students had English as their native language, as well as students who attended schools where this was the case for 51–90% of students, had higher average mathematics achievement than students who attended schools where 90% of students had the English as their native language.

Socioeconomic differences

Figure 2.4 presents the proportions of Australian students by the language background and socioeconomic composition of their schools. It shows that in Australia, there are differences in the language background of schools' populations according to the schools' socioeconomic composition.

At Year 4, for students from *more affluent* schools, 58% of students attended schools where 90% of students had English as their native language and only 8% attended schools where 50% or less of students had English as their native language. In comparison, for students from *more disadvantaged* schools, 39% of students attended schools where 90% of students had English as their native language and 26% attended schools where 50% or less of students had English as their native language. These differences were statistically significant.

At Year 8, similar patterns can be seen, but none of the differences were significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 2.4 Language background of schools' populations, in Australia, by school socioeconomic composition

2.3 Students enter school with literacy and numeracy skills

Year 4 principals were asked to comment on how many students in their school could do the following when they began their first year of primary school ('more than 75%', '51–75%', '25–50%' or 'less than 25%'):

- ▶ recognise most of the letters of the alphabet
- ▶ read some words
- ▶ read sentences
- ▶ write letters of the alphabet
- ▶ write their names

- ▶ write some words other than their names
- ▶ count up to 100 or higher
- ▶ recognise written numbers from 1 to 10
- ▶ recognise written numbers higher than 10
- ▶ write numbers from 1 to 10
- ▶ do simple addition
- ▶ do simple subtraction.

Principals' responses were combined to create the Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale. Students were then assigned to three groups based on their principals' scale scores.

Year 4 students who attended schools where more than 75% of students enter with skills had a scale score of at least 11.5, which corresponded to principals reporting that more than 75% of students had six of the skills and between 51–75% of the students had the other six, on average. Students who attended schools where less than 25% enter with skills had a scale score no higher than 8.5, which corresponded to principals reporting that less than 25% of the students had six of the skills and 25–50% of the students had the other six, on average. All other students attended schools where between 25% to 75% enter with skills.

Figure 2.5 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

At Year 4, 9% of Australian students attended schools where more than 75% of students enter school with skills; 43% attended schools where 25–75% enter school with skills; and 47% attended schools where less than 25% of students enter school with skills. In comparison, internationally, on average, 24% of students attended schools where more than 75% of students enter school with skills; 56% attended schools where 25–75% enter school with skills; and 20% attended schools where less than 25% of students enter school with skills.

Figure 2.5 indicates that some interesting conclusions may be drawn from the TIMSS 2019 data. There was no significant difference in the average achievement between students who attended schools where more than 75% of students started school with skills and students who attended schools where between 25–75% of students started school with skills. In contrast, students who attended schools where less than 25% of students entered with literacy and numeracy skills recorded average mathematics and science scores that were around 30 points lower than the scores recorded by the other two groups. A similar size gap was found internationally.

FIGURE 2.5 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale and student achievement in mathematics and science, Australia and the international averages

Socioeconomic differences

Figure 2.6 presents the proportions of Australian students in each of the categories of students who entered school with skills, by school socioeconomic composition. In Australia, there were differences in the percentages of students who enter school with skills according to the schools' socioeconomic composition.

At Year 4, 32% of students who attended schools with a *more affluent* student body were at schools where less than 25% entered school with literacy and numeracy skills, compared to 48% of students who were at schools that were *neither more affluent nor more disadvantaged*, and 67% of students who were at schools that were *more disadvantaged*. These differences were statistically significant.

Looking at the other end of the scale, 14% of students who attended *more affluent* schools also attended schools where more than 75% enter school with skills, compared to 3% of students who attended *more disadvantaged* schools. This difference was also statistically significant.

Students enter school with skills and school socioeconomic composition

Note: Due to rounding, totals may not add to 100%.

FIGURE 2.6 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale, in Australia, by school socioeconomic composition

Geolocation differences

Figure 2.7 presents the proportions of Australian students in each of the categories of students who entered school with skills, by the geographic location of their schools. In Australia, there were differences in the percentages of students who enter school with skills according to the geographic location of the schools.

At Year 4, 44% of students who attended schools in *major cities* were at schools where less than 25% enter school with skills, compared to 59% of students who attended schools in *regional and remote areas*. These differences were statistically significant.

Looking at the other end of the scale, 10% of students who attended schools in *major cities* were at schools where more than 75% enter school with skills, compared to 6% of students who attended schools in *regional and remote areas*. This difference was not statistically significant.

Students enter school with skills and geographic location

FIGURE 2.7 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale, in Australia, by school geographic location

2.4 Instruction affected by mathematics resource shortages

Principals were asked to comment on the degree to which their school's capacity to provide instruction was affected by a shortage of – or inadequacy in – general and mathematics instruction resources ('not at all', 'a little', 'some' or 'a lot').

General school resources

- ▶ instructional materials (e.g. textbooks)
- ▶ supplies (e.g. papers, pencils, materials)
- ▶ school buildings and grounds
- ▶ heating/cooling and lighting systems
- ▶ instructional space (e.g. classrooms)
- ▶ technologically competent staff
- ▶ audio-visual resources for delivery of instruction (e.g. interactive white boards, digital projectors)
- ▶ computer technology for teaching and learning (e.g. computers or tablets for student use).

Resources for mathematics instruction

- ▶ teachers with a specialisation in mathematics
- ▶ computer software/applications for mathematics instruction
- ▶ library resources relevant to mathematics instruction
- ▶ calculators for mathematics instruction
- ▶ concrete objects or materials to help students understand quantities or procedures.

Principals' responses to these 13 items were combined to create the Mathematics Resource Shortages scale. Students were then assigned to groups based on their principals' scale scores.

Figure 2.8 presents the proportions of students in each of these categories, along with their average mathematics scores.

At Year 4, students who attended schools where instruction was *not affected* by resource shortages had a scale score of at least 11.3, which corresponded to principals reporting that shortages affected instruction ‘not at all’ for seven of the 13 resources and ‘a little’ for the other six, on average. Students who attended schools where instruction was *affected a lot* had a scale score no higher than 6.7, which corresponded to principals reporting that shortages affected instruction ‘a lot’ for seven of the 13 resources and ‘some’ for the other six, on average. All other students attended schools where instruction was *somewhat affected* by resource shortages.

At Year 8, students who attended schools where instruction was *not affected* by resource shortages had a scale score of at least 11.0, which corresponded to principals reporting that shortages affected instruction ‘not at all’ for seven of the 13 resources and ‘a little’ for the other six, on average. Students who attended schools where instruction was *affected a lot* had a scale score no higher than 7.5, which corresponded to principals reporting that shortages affected instruction ‘a lot’ for seven of the 13 resources and ‘some’ for the other six, on average. All other students attended schools where instruction was *somewhat affected* by resource shortages.

Note: Due to rounding, totals may not add to 100%.

* Insufficient data to report achievement for Australia in this category.

FIGURE 2.8 The Mathematics Resource Shortages scale and student achievement in mathematics, Australia and the international averages

At Year 4, 44% of students attended schools where mathematics instruction was *not affected* by resource shortages; 53% attended schools where it was *somewhat affected*; and 3% attended schools where mathematics instruction was *affected a lot* by resource shortages. In comparison, for the international averages, 26% of students attended schools where mathematics instruction was *not affected* by resource shortages; 68% attended schools where it was *somewhat affected*; and 6% attended schools where mathematics instruction was *affected a lot* by resource shortages.

At Year 8, 62% of students attended schools where mathematics instruction was *not affected* by resource shortages; 37% attended schools where it was *somewhat affected*; and 2% attended schools where mathematics instruction was *affected a lot* by resource shortages. In comparison, for the international averages, 30% of students attended schools where mathematics instruction was *not affected* by resource shortages; 63% attended schools where it was *somewhat affected*; and 7% attended schools where mathematics instruction was *affected a lot* by resource shortages.

Interestingly, resource shortages had a greater impact on mathematics scores for Year 4 students than for Year 8 students. That is, there were no significant differences between the groups in terms of average mathematics achievement at Year 4. However, Year 8 students who attended schools where mathematics instruction was *not affected* by resource shortages achieved an average mathematics score that was significantly higher than those students who attended schools where instruction was *somewhat affected* (the number of students in the *affected a lot* category was too small to calculate average achievement).

Socioeconomic differences

Figure 2.9 presents the proportions of Australian students in each of the instruction affected by resource shortages categories by school socioeconomic composition. It shows that, in Australia, the percentages of students who attended schools affected by mathematics resource shortages varied according to the schools' socioeconomic composition.

At Year 4, most of the variation was not significant. However, 44% of students who attended *more affluent* schools were at schools where mathematics instruction was somewhat affected by resource shortages, compared to 63% of students who attended *more disadvantaged* schools. This difference was statistically significant.

At Year 8, 76% of students who attended *more affluent* schools were at schools where mathematics instruction was not affected by resource shortages, compared to 59% of students who attended schools that were *neither more affluent nor more disadvantaged*, and 44% of students who attended schools that were *more disadvantaged*. Conversely, 55% of students who attended *more disadvantaged* schools were at schools where mathematics instruction was somewhat affected by resource shortages, compared to 36% of students who attended schools that were *neither more affluent nor more disadvantaged* and 24% of students who attended schools with a *more affluent* student body. These differences were statistically significant.

FIGURE 2.9 The Mathematics Resource Shortages scale, in Australia, by school socioeconomic composition

2.5 Instruction affected by science resource shortages

Principals were asked to comment on the degree to which their school's capacity to provide instruction was affected by a shortage of – or inadequacy in – general and science instruction resources ('not at all', 'a little', 'some' or 'a lot').

General school resources

- ▶ instructional materials (e.g. textbooks)
- ▶ supplies (e.g. papers, pencils, materials)
- ▶ school buildings and grounds
- ▶ heating/cooling and lighting systems
- ▶ instructional space (e.g. classrooms)
- ▶ technologically competent staff
- ▶ audio-visual resources for delivery of instruction (e.g. interactive white boards, digital projectors)
- ▶ computer technology for teaching and learning (e.g. computers or tablets for student use).

Resources for science instruction

- ▶ teachers with a specialisation in science
- ▶ computer software/applications for science instruction
- ▶ library resources relevant to science instruction
- ▶ science equipment and materials for experiments
- ▶ calculators for science instruction (Year 8 only).

Principals' responses to these 13 items were combined to create the Science Resource Shortages scale. Students were then assigned to three groups based on their principals' scale scores.

Figure 2.10 presents the proportions of students in each of these categories, along with their average science scores.

At Year 4, students who attended schools where instruction was *not affected* by resource shortages had a scale score of at least 11.4, which corresponded to principals reporting that shortages affected instruction 'not at all' for six of the 12 resources and 'a little' for the other six, on average. Students who attended schools where instruction was *affected a lot* had a scale score no higher than 7.0, which corresponded to principals reporting that shortages affected instruction 'a lot' for six of the 12 resources and 'some' for the other six, on average. All other students attended schools where instruction was *somewhat affected* by resource shortages.

At Year 8, students who attended schools where instruction was *not affected* by resource shortages had a scale score of at least 11.1, which corresponded to principals reporting that shortages affected instruction 'not at all' for seven of the 13 resources and 'a little' for the other six, on average. Students who attended schools where instruction was *affected a lot* had a scale score no higher than 7.5, which corresponded to principals reporting that shortages affected instruction 'a lot' for seven of the 13 resources and 'some' for the other six, on average. All other students attended schools where instruction was *somewhat affected* by resource shortages.

Note: Due to rounding, totals may not add to 100%.

* Insufficient data to report achievement for Australia in this category.

FIGURE 2.10 The Science Resource Shortages scale and student achievement in science, Australia and the international averages

At Year 4, 37% of Australian students attended schools where science instruction was *not affected* by resource shortages; 61% attended schools where it was *somewhat affected*; and 2% attended schools where science instruction was *affected a lot* by resource shortages. In comparison, for the international averages, 24% of students attended schools where science instruction was *not affected* by resource shortages; 69% attended schools where it was *somewhat affected*; and 7% attended schools where science instruction was *affected a lot* by resource shortages.

At Year 8, 63% of Australian students attended schools where science instruction was *not affected* by resource shortages; 35% attended schools where it was *somewhat affected*; and 2% attended schools where science instruction was *affected a lot* by resource shortages. In comparison, for the international averages, 30% of students attended schools where science instruction was *not affected* by resource shortages; 62% attended schools where it was *somewhat affected*; and 8% attended schools where science instruction was *affected a lot* by resource shortages. Australia had the second highest percentage of Year 8 students who attended schools where science instruction was *not affected* by resource shortages after Singapore (75%).

Interestingly, while there were no significant differences between the groups in terms of average science achievement at Year 4, Australian Year 8 students who attended schools where science instruction was *not affected* by resource shortages achieved an average science score that was significantly higher than students who attended schools where instruction was *somewhat affected* (the number of students in the *affected a lot* category was too small to calculate average achievement).

The differences between Year 4 and Year 8, both in terms of the percentages in each of the groups and the relationship to achievement, are likely to reflect the fact that Australian primary school teachers do not tend to have subject specialisations and Australian primary schools do not tend to have specialised scientific equipment and resources, so they are most likely to have fallen in the *somewhat affected* category. As the lack of specialisation is common and expected, Australian primary science curricula are written so that they can be taught within these parameters, which means there should not be as strong a relationship with achievement.

Socioeconomic differences

Figure 2.11 presents the proportions of Australian students in each of the instruction affected by resource shortages categories, by school socioeconomic composition. It shows that, in Australia, the percentages of students who attended schools affected by science resource shortages varied according to the schools' socioeconomic composition.

At Year 4, most of the variation was not significant. However, 50% of students who attended *more affluent* schools were at schools where science instruction was *somewhat affected* by resource shortages, compared to 70% of students who attended *more disadvantaged* schools. This difference was statistically significant.

At Year 8, 78% of students who attended *more affluent* schools were at schools where science instruction was *not affected* by resource shortages, compared to 59% of students who attended *neither more affluent nor more disadvantaged* schools and 45% of students who attended *more disadvantaged* schools. Conversely, 54% of students who attended *more disadvantaged* schools were at schools where science instruction was *somewhat affected* by resource shortages, compared to 36% of students at schools that were *neither more affluent nor more disadvantaged*, and 22% of students who attended *more affluent* schools. These differences were statistically significant.

FIGURE 2.11 The Science Resource Shortages scale, in Australia, by school socioeconomic composition

2.6 Formal qualifications of principals

TIMSS 2019 collected information on the formal qualifications of principals, including whether they had specialised training in educational leadership.

Table 2.1 shows the percentages of Year 4 and Year 8 students by the formal education of their principals, including educational leadership qualifications. The table shows results for Australia and the international averages.

At Year 4, 40% of Australian students attended schools whose principals had *completed a postgraduate university degree* (i.e. doctorate, master's or other postgraduate degree), compared to 54%, on average, across countries. In addition, 31% of Australian students attended schools whose principals had a *postgraduate degree in educational leadership*, compared to 36%, internationally.

At Year 8, 58% of Australian students attended schools whose principals had *completed a postgraduate university degree*, compared to 55%, on average, across countries. In addition, 50% of Australian students attended schools with principals who had a *postgraduate degree in educational leadership*, compared to 39%, internationally.

The percentages of students who attended schools with principals who had *completed a postgraduate degree* varied widely among participating TIMSS countries. In the United States, 98% of students (at both year levels) attended schools whose principals had *completed a postgraduate degree*, whereas in Japan, by way of contrast, only around 10% of students (13% at Year 4 and 8% at Year 8) attended schools whose principals had *completed a postgraduate degree*. In many cases, the percentages of students who attended schools with principals who had completed a postgraduate degree was higher at Year 8 than at Year 4. This was true for Australia (40% at Year 4; 58% at Year 8), New Zealand (47% at Year 4; 79% at Year 8), Ireland (53% at Year 4; 77% at Year 8) and England (22% at Year 4; 51% at Year 8).

TABLE 2.1 Formal education of principals, Australia and the international averages

	Percentages of students by principals' educational level						Students who had a principal with a postgraduate degree in educational leadership (%)	
	Completed postgraduate university degree		Completed bachelor's degree or equivalent but not a postgraduate degree		Did not complete bachelor's degree			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	40	3.0	59	2.9	1	0.8	31	2.7
International average	54	0.4	42	0.4	5	0.2	36	0.5
Year 8								
Australia	58	2.9	42	2.9	0	0.0	50	3.0
International average	55	0.5	43	0.5	2	0.2	39	0.5

Note: Due to rounding, totals may not add to 100%.

Socioeconomic differences

Table 2.2 shows the percentages of Year 4 and Year 8 students by the formal education of their principals, including educational leadership qualifications, by school socioeconomic composition.

At Year 4, there were no significant differences between the socioeconomic groups in terms of principals' formal education, including qualifications in educational leadership.

However, at Year 8, students who attended *more affluent* schools were significantly more likely to have principals with a postgraduate university degree (74% of students) compared with students who attended *neither more affluent nor more disadvantaged* schools or *more disadvantaged* schools (both 48%). In addition, students who attended *more affluent* schools were significantly more likely to have principals with a postgraduate degree in educational leadership (65% of students) compared with students who attended *neither more affluent nor more disadvantaged* schools or *more disadvantaged* schools (43% and 38%, respectively).

TABLE 2.2 Formal education of Australian principals, by school socioeconomic composition

	Percentages of students by principals' educational level						Students who had a principal with a postgraduate degree in educational leadership (%)	
	Completed postgraduate university degree		Completed bachelor's degree or equivalent but not a postgraduate degree		Did not complete bachelor's degree			
	Students (%)	SE	Students (%)	SE	Students (%)	SE		
Year 4								
More affluent	45	6.2	55	6.2	~	~	40	6.2
Neither more affluent nor more disadvantaged	42	6.7	56	6.5	2.0	2.0	26	4.8
More disadvantaged	30	5.8	70	5.8	~	~	24	6.3
Year 8								
More affluent	74	5.7	26	5.7	~	~	65	5.2
Neither more affluent nor more disadvantaged	48	5.9	52	5.9	~	~	43	5.9
More disadvantaged	48	7.3	52	7.3	~	~	38	7.7

Note: Due to rounding, totals may not add to 100%.

Geolocation differences

Table 2.3 shows the percentages of Year 4 and Year 8 students by the formal education of their principals, including qualifications in educational leadership, by the geographic location of the schools. At both Year 4 and Year 8, there were no significant differences between schools in *major cities* and schools in *regional and remote areas* in terms of principals' formal education, including qualifications in educational leadership.

TABLE 2.3 Formal education of Australian principals, by school geographic location

	Percentages of students by principals' educational level						Students who had a principal with a postgraduate degree in educational leadership (%)	
	Completed postgraduate university degree		Completed bachelor's degree or equivalent but not a postgraduate degree		Did not complete bachelor's degree			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Major cities	43	4.1	56	3.9	1	1.0	34	3.4
Regional and remote	30	6.7	70	6.7	~	~	20	6.2
Year 8								
Major cities	62	3.6	38	3.6	~	~	52	3.6
Regional and remote	50	7.0	50	7.0	~	~	43	7.7

Note: Due to rounding, totals may not add to 100%.

2.7 Principals' years of experience

Table 2.4 shows the percentages of students according to the experience of their principal – expressed as the number of years that principals had worked in that position. The table shows the results for Australia and the international averages.

At Year 4, 11% of students attended schools with principals who had *20 years or more* experience as a principal; 32% attended schools with principals who had *at least 10 but less than 20 years'* experience; 21% attended schools with principals who had *at least 5 but less than 10 years'* experience; and 36% of students attended schools where the principals had *less than 5 years* of experience. On average, Australian principals had 9 years of experience, compared to the international average of 10 years.

At Year 8, 8% of students attended schools with principals who had *20 years or more* experience as a principal; 35% attended schools with principals who had *at least 10 but less than 20 years'* experience; 30% attended schools with principals who had *at least 5 but less than 10 years'* experience; and 27% of students attended schools where the principals had *less than 5 years* of experience. On average, Australian principals had 9 years of experience, similar to the international average.

TABLE 2.4 Principals' years of experience, Australia and the international average

	Percentages of students by principals' years of experience								Average years of experience as a principal	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
Australia	11	2.2	32	3.0	21	3.9	36	3.9	9	0.5
International average	13	0.4	29	0.5	27	0.5	31	0.5	10	0.1
Year 8										
Australia	8	1.9	35	4.5	30	4.1	27	3.2	9	0.5
International average	11	0.4	28	0.6	28	0.6	34	0.6	9	0.1

Note: Due to rounding, totals may not add to 100%.

Socioeconomic differences

Table 2.5 shows the percentages of students according to the experience of their principal – expressed as the number of years that their principal had worked in the position of school principal. The table shows Australian results by school socioeconomic composition.

At both Year 4 and Year 8, there were no significant differences between the socioeconomic groups in terms of principals' years of experience.

TABLE 2.5 Australian principals' years of experience, by school socioeconomic composition

	Percentages of students by principals' years of experience								Average years of experience as a principal	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
More affluent	12	4.1	34	6.0	15	5.3	39	7.3	9	0.9
Neither more affluent nor more disadvantaged	10	4.0	31	5.7	19	6.2	40	6.5	9	1.1
More disadvantaged	12	3.6	32	6.8	32	7.5	23	6.2	11	1.1
Year 8										
More affluent	8	3.4	42	8.1	29	8.2	21	4.3	10	0.9
Neither more affluent nor more disadvantaged	9	2.9	31	6.0	32	6.0	29	5.9	9	0.8
More disadvantaged	9	3.9	30	8.0	28	7.2	33	6.9	9	1.1

Note: Due to rounding, totals may not add to 100%.

Geolocation differences

Table 2.6 shows the percentages of students according to the experience of their principal – expressed as the number of years that their principal had worked in the position of school principal. The table shows Australian results by school geographic location.

At both Year 4 and Year 8, there were no significant differences between schools in *major cities* and schools in *regional and remote areas* in terms of principals' years of experience, except for Year 8 in the category of at least 10 but less than 20 years' experience (42% and 18%, respectively).

TABLE 2.6 Australian principals' years of experience, by school geographic location

	Percentages of students by principals' years of experience								Average years of experience as a principal	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
Major cities	13	3.0	30	3.6	20	4.5	37	4.7	10	0.7
Regional and remote	6	3.2	37	7.0	25	7.2	32	7.1	9	1.1
Year 8										
Major cities	7	2.4	42	5.8	27	5.2	23	4.0	10	0.6
Regional and remote	11	3.1	18	4.8	36	5.8	36	4.9	8	0.7

Note: Due to rounding, totals may not add to 100%.

CHAPTER 3

SCHOOL CLIMATE, DISCIPLINE AND SAFETY

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- 9% of Year 4 students and 17% of Year 8 students attended schools whose principals reported a *very high* emphasis on academic success in their schools. These students had significantly higher average mathematics and science achievement than those from schools whose principals reported a *high* or *medium* emphasis on academic success.
- A higher percentage of students from *more affluent* schools than those from *more disadvantaged* schools had principals who reported a very high emphasis on academic success in their school.
- Year 4 and Year 8 students with a *high* sense of school belonging had higher achievement in mathematics and science than students with *little* sense of school belonging. This relationship was stronger at Year 8 than at Year 4.
- While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students at *more affluent* schools than those from *more disadvantaged* schools reported a high sense of school belonging.
- Students who attended schools whose principals reported *hardly any* problems with school discipline had higher achievement in mathematics and science than students from schools whose principals reported *moderate to severe* problems with school discipline.
- A higher percentage of students who attended *more affluent* schools than those from *more disadvantaged* schools had principals who reported hardly any problems with school discipline.
- Students with mathematics and science teachers who reported that their schools were *very safe and orderly* had higher achievement in mathematics and science than students whose teachers reported that their schools were *less than safe and orderly*.
- A higher percentage of students from *more affluent* schools than those from *more disadvantaged* schools had mathematics and science teachers who reported that their schools were very safe and orderly.
- 46% of Year 4 students and 36% of Year 8 students reported being bullied at least monthly. Students who *never or almost never* experienced bullying had higher achievement in mathematics and science than students who reported being bullied *about monthly* or *about weekly*.
- While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students from *more affluent* schools than those from *more disadvantaged* schools reported never being bullied.
- 7% of Year 4 students and 5% of Year 8 students reported being absent from school at least once a week. These students had significantly lower achievement in mathematics and science than students who reported never being absent (around 50% of students).

KEY FINDINGS

- While there were no significant differences between the socioeconomic groups at Year 8, a higher percentage of Year 4 students from *more disadvantaged* schools than those from *more affluent* schools were absent once a week.
- 34% of Year 4 students and 49% of Year 8 students reported coming to school feeling tired every day or almost every day. A higher percentage of Year 4 students from *more disadvantaged* schools than those from *more affluent* schools reported coming to school feeling tired every day or almost every day.
- 28% of Year 4 students and 27% of Year 8 students reported coming to school feeling hungry every day or almost every day. These students had significantly lower achievement than students who reported never coming to school feeling hungry (around 30% of students for both year levels).
- A higher percentage of students from *more disadvantaged* schools than those from *more affluent* schools reported coming to school feeling hungry every day or almost every day.

Chapter 2 presented data on Australian schools in terms of their characteristics and resources. Chapter 3 focuses on the social and emotional components of the school environment that can affect achievement, using data collected through the School, Student and Teacher Questionnaires. Chapters 2 and 3 present information on the school context for teaching and learning mathematics and science for Australian Year 4 and Year 8 students.

As TIMSS focuses on student outcomes, results from the Teacher and School Questionnaires are presented with regard to students. This means that each result is reported as the percentage of students who attended schools that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 3 section of the Appendices.

3.1 Principals' reports of school emphasis on academic success

The views of principals regarding the academic climate of their schools, that is, the degree to which their school community supports and encourages academic success, were collected using principals' ratings of a range of aspects ('very high', 'high', 'medium', 'low' or 'very low'):

- ▶ teachers' understanding of the school's curricular goals
- ▶ teachers' degree of success in implementing the school's curriculum
- ▶ teachers' expectations for student achievement
- ▶ teachers' ability to inspire students
- ▶ parental involvement in school activities
- ▶ parental commitment to ensure that students are ready to learn
- ▶ parental expectations for student achievement
- ▶ parental support for student achievement
- ▶ students' desire to do well in school
- ▶ students' ability to reach school's academic goals
- ▶ students' respect for classmates who excel academically.

The principals' responses to these 11 items were combined to create the School Emphasis on Academic Success scale. Students were then assigned to three groups based on their principals' scale scores.

At Year 4, students who attended schools whose principals reported a *very high* emphasis on academic success had a scale score of at least 13.0, which corresponded to principals' characterising six of the 11 aspects as 'very high' and the other five as 'high', on average. Students who attended schools with a *medium* emphasis on academic success had a scale score no higher than 9.2, which corresponded to principals' characterising six of the 11 aspects as 'medium' and the other five as 'high', on average. All other students attended schools with a *high* emphasis on academic success.

At Year 8, students who attended schools whose principals reported a *very high* emphasis on academic success had a scale score of at least 13.1, which corresponded to principals' characterising six of the 11 aspects as 'very high' and the other five as 'high', on average. Students who attended schools with a *medium* emphasis on academic success had a scale score no higher than 9.6, which corresponded to principals' characterising six of the 11 aspects as 'medium' and the other five as 'high', on average. All other students attended schools with a *high* emphasis on academic success.

Figure 3.1 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.1 The School Emphasis on Academic Success scale and student achievement in mathematics and science, Australia and the international averages

At Year 4, 9% of Australian students attended schools whose principals reported a *very high* emphasis on academic success; 53% attended schools with a *high* emphasis; and 38% attended schools with a *medium emphasis* on academic success. In comparison, for the international averages, 7% of students attended schools whose principals reported a *very high* emphasis on academic success; 55% attended schools with a *high* emphasis; and 37% attended schools with a *medium emphasis* on academic success.

At Year 8, 17% of Australian students attended schools whose principals reported a *very high* emphasis on academic success; 46% attended schools with a *high* emphasis; and 37% attended schools with a *medium* emphasis on academic success. In comparison, for the international averages, 8% of students attended schools whose principals reported a *very high* emphasis on academic success; 49% attended schools with a *high* emphasis; and 43% attended schools with a *medium* emphasis on academic success.

As can be seen in Figure 3.1, there is a clear relationship between the achievement of Australian students and principals' reports of school emphasis on academic success; a higher school emphasis on academic success was associated with higher achievement (a correlation of around 0.22 at Year 4 and 0.45 at Year 8). The difference between the average achievement of Australian students who attended schools whose principals reported a *very high* emphasis and those who reported a *medium emphasis* on academic success was between 51 points for Year 4 science and 106 points for Year 8 mathematics. The differences between all groups were statistically significant for both subjects at both year levels. Internationally, on average, the gap was between 29 points for Year 4 mathematics and 69 points for Year 8 mathematics.

Socioeconomic differences

Figure 3.2 presents the percentages of Australian students in each of the three categories of the School Emphasis on Academic Success scale according to school socioeconomic composition. It shows that at both Year 4 and Year 8, students who attended *more affluent* schools were more likely to have principals who reported a very high emphasis on academic success than students who attended *more disadvantaged* schools.

At Year 4, 18% of students who attended *more affluent* schools had principals who reported a very high emphasis on academic success, compared to 5% of students at *neither more affluent nor more disadvantaged schools* and 3% of students at *more disadvantaged schools*. Conversely, 66% of students who attended *more disadvantaged* schools had principals who reported a medium emphasis on academic success, compared to 30% of students at *neither more affluent nor more disadvantaged schools* and 24% of students who attended *more affluent* schools.

At Year 8, 31% of students who attended *more affluent* schools had principals who reported a very high emphasis on academic success, compared to 16% of students at *neither more affluent nor more disadvantaged schools* and no students at *more disadvantaged schools*. Conversely, 74% of students who attended *more disadvantaged* schools had principals who reported a medium emphasis on academic success, compared to 38% of students at *neither more affluent nor more disadvantaged schools* and 11% of students at *more affluent* schools.

All of the differences between the *more affluent* schools and *more disadvantaged* schools were statistically significant. The difference between *more affluent schools* and *neither more affluent nor more disadvantaged schools* in the percentage of students whose principals reported a very high emphasis on academic success was significant at Year 4, whereas these groups significantly differed in the percentage of students who had principals who reported a medium emphasis on academic success at Year 8. There were significant differences between *neither more affluent nor more disadvantaged schools* and *more disadvantaged schools* in the percentages of students who had principals who reported a high or medium emphasis on academic success at both year levels.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.2 The School Emphasis on Academic Success scale, in Australia, by school socioeconomic composition

3.2 Students' sense of belonging

Students were asked to comment on how they felt about being at school. Students indicated how much they agreed with the following statements ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot'):

- ▶ I like being in school.
- ▶ I feel safe when I am at school.
- ▶ I feel like I belong at this school.
- ▶ Teachers at my school are fair to me.
- ▶ I am proud to go to this school.

Responses to these five items were combined to create the Students' Sense of School Belonging scale, and scale scores were used to classify students according to three response groups.

Figure 3.3 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

At Year 4, students with a *high* sense of school belonging had a scale score of at least 9.6, which corresponded to their 'agreeing a lot' with three of the five statements and 'agreeing a little' with each of the other two statements, on average. Students with *little* sense of school belonging had a scale score no higher than 7.2, which corresponded to their 'disagreeing a little' with three of the five statements and 'agreeing a little' with each of the other two statements, on average. All other students had *some* sense of school belonging.

At Year 8, students with a *high* sense of school belonging had a scale score of at least 10.7, which corresponded to their 'agreeing a lot' with three of the five statements and 'agreeing a little' with each of the other two statements, on average. Students with *little* sense of school belonging had a scale score no higher than 7.8, which corresponded to their 'disagreeing a little' with three of the five statements and 'agreeing a little' with each of the other two statements, on average. All other students had *some* sense of school belonging.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.3 The Students' Sense of School Belonging scale and student achievement in mathematics and science, Australia and the international averages

At Year 4, 54% of Australian students had a *high* sense of school belonging; 36% had *some* sense of school belonging; and 10% had *little* sense of school belonging. The international averages were similar where 58% of Year 4 students had a *high* sense of school belonging; 34% had *some* sense of school belonging; and 8% had *little* sense of school belonging.

At Year 8, 30% of Australian students had a *high* sense of school belonging; 50% had *some* sense of school belonging; and 20% had *little* sense of school belonging. In comparison, for the international averages, 37% of Year 8 students had a *high* sense of school belonging; 49% had *some* sense of school belonging; and 14% had *little* sense of school belonging.

As can be seen in Figure 3.3, there is a clear relationship between students' achievement and their sense of school belonging; a higher sense of school belonging is associated with higher achievement. The relationship appears stronger at Year 8 than at Year 4 (a correlation of 0.15 at Year 4 and 0.30 at Year 8). At Year 4, Australian students with a *high* sense of school belonging scored around 30 points higher than those with *little* sense of school belonging. In comparison, Australian Year 8 students with a *high* sense of school belonging scored around 70 points higher than those with *little* sense of school belonging. Internationally, on average, the gap between *high* and *low* sense of belonging was 21 points for Year 4 science and 32 points for Year 8 science.

Socioeconomic differences

Figure 3.4 presents the percentages of Australian students in each of the three categories of the Students' Sense of School Belonging scale, according to school socioeconomic composition. It shows that at Year 4 there was very little difference in the percentages of Australian students in each of the three categories of Students' Sense of School Belonging scale across the socioeconomic groups. Slightly more than 50% of all students in *more affluent*, *neither more affluent nor more disadvantaged* and *more disadvantaged* had a high sense of school belonging, just over 30% of students in each category had some sense of school belonging, while about 10% had little sense of school belonging.

However, at Year 8, there were clear differences between the socioeconomic groups. Students who attended *more affluent* schools were more likely to report a high sense of school belonging and less likely to report little sense of school belonging than students who attended *neither more affluent nor more disadvantaged schools* or *more disadvantaged schools*. That is, 40% of students who attended *more affluent* schools reported a high sense of school belonging, compared to 27% of students at *neither more affluent nor more disadvantaged schools* and 21% of students at *more disadvantaged schools*. Conversely, 28% of students who attended *more disadvantaged schools* reported little sense of school belonging, compared to 20% of students at *neither more affluent nor more disadvantaged schools* and 13% of students who attended *more affluent schools*.

There were no significant differences found at Year 4. At Year 8, all differences were significant, except for the percentage of students who reported some sense of school belonging.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.4 The Students' Sense of School Belonging scale, in Australia, by school socioeconomic composition

3.3 Principals' reports of school discipline problems

Principals were asked to indicate the degree to which each of the following behaviours and issues was problematic among Year 4 or Year 8 students in their school ('not a problem', 'minor problem', 'moderate problem' or 'serious problem'):

- ▶ arriving late at school
- ▶ absenteeism (i.e. unjustified absences)
- ▶ classroom disturbance
- ▶ cheating
- ▶ swearing
- ▶ vandalism
- ▶ theft
- ▶ intimidation or verbal abuse among students (including texting, emailing etc.)
- ▶ physical injury to other students
- ▶ intimidation or verbal abuse of teachers or staff (including texting, emailing etc.)
- ▶ physical injury to teachers or staff (Year 8 only).

The principals' responses to these 11 items were combined to create the School Discipline Problems scale. Students were then assigned to three groups based on their principals' scale scores.

At Year 4, students in schools with *hardly any* problems had a scale score of at least 9.7, which corresponded to principals reporting ‘not a problem’ for five of the 10 issues and ‘minor problem’ for the other five, on average. Students in schools with *moderate to severe* problems had a scale score no higher than 7.6, which corresponded to principals reporting ‘moderate problem’ for five of the 10 issues and ‘minor problem’ for the other five, on average. All other students attended schools with *minor* problems.

At Year 8, students in schools with *hardly any* problems had a scale score of at least 10.8, which corresponded to principals reporting ‘not a problem’ for six of the 11 issues and ‘minor problem’ for the other five, on average. Students in schools with *moderate to severe* problems had a scale score no higher than 8.0, which corresponded to principals reporting ‘moderate problem’ for six of the 11 issues and ‘minor problem’ for the other five, on average. All other students attended schools with *minor* problems.

Figure 3.5 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.5 The School Discipline Problems scale and student achievement in mathematics and science, Australia and the international averages

At Year 4, 57% of Australian students attended schools whose principals reported *hardly any* problems with school discipline; 40% attended schools whose principals reported *minor* problems; and 3% attended schools whose principals reported *moderate to severe* problems. In comparison, for the international averages, 60% of students attended schools whose principals reported *hardly any* problems with school discipline; 32% attended schools with *minor* problems; and 8% attended schools with *moderate to severe* problems with school discipline.

At Year 8, 50% of Australian students attended schools whose principals reported *hardly any* problems with school discipline; 44% attended schools with *minor* problems; and 6% attended schools with *moderate to severe* problems with school discipline. For the international averages, 45% of students attended schools whose principals reported *hardly any* problems with school discipline; 43% attended schools with *minor* problems; and 11% attended schools with *moderate to severe* problems with school discipline.

As can be seen in Figure 3.5, there is a clear relationship between students' achievement and principals' reports of school disciplinary problems, with fewer disciplinary problems associated with higher achievement (a correlation of around 0.25 at Year 4 and 0.35 at Year 8). The difference between the average achievement of Australian students who attended schools whose principals reported *hardly any* problems with school discipline and students at schools with *moderate to severe* problems with school discipline was between 75 points for Year 8 science and 86 points for Year 4 mathematics. The differences between all groups were statistically significant for both subjects at both year levels. Internationally, on average, the gap between *hardly any* problems and *moderate to severe* problems was around 40 points at Year 4 and around 55 points at Year 8.

Socioeconomic differences

Figure 3.6 presents the percentages of Australian students in each of the three categories of the School Discipline Problems scale, according to school socioeconomic composition.

At both Year 4 and Year 8, students who attended *more affluent* schools were more likely to have a principal who reported *hardly any* problems with school discipline, and less likely to have a principal who reported moderate to severe problems with school discipline, than students who attended *more disadvantaged* schools.

At Year 4, 82% of students who attended *more affluent* schools had principals who reported *hardly any* problems with school discipline, compared to 56% of students at *neither more affluent nor more disadvantaged* schools and 29% of students who attended *more disadvantaged* schools. Conversely, 7% of students who attended *more disadvantaged* schools had principals who reported moderate to severe problems with school discipline, compared to 3% of students at *neither more affluent nor more disadvantaged* schools and no students who attended *more affluent* schools.

At Year 8, 73% of students who attended *more affluent* schools had principals who reported *hardly any* problems with school discipline, compared to 50% of students at *neither more affluent nor more disadvantaged* schools and 20% of students who attended *more disadvantaged* schools. Conversely, 15% of students who attended *more disadvantaged* schools had principals who reported moderate to severe problems with school discipline, compared to 6% of students at *neither more affluent nor more disadvantaged* schools and 0.2% students who attended *more affluent* schools.

All of the differences at both year levels were statistically significant, except for between students at *neither more affluent nor more disadvantaged* schools and students at *more affluent* schools and *more disadvantaged* schools in the percentage of students who had principals who reported moderate to severe problems with school discipline.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.6 The School Discipline Problems scale, in Australia, by school socioeconomic composition

3.4 Teachers' reports of safe and orderly schools

Teachers were asked to indicate the extent of their agreement with the following statements ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot'):

- ▶ This school is located in a safe neighbourhood.
- ▶ I feel safe at this school.
- ▶ This school's security policies and practices are sufficient.
- ▶ The students behave in an orderly manner.
- ▶ The students are respectful of the teachers.
- ▶ The students respect school property.
- ▶ This school has clear rules about student conduct.
- ▶ This school's rules are enforced in a fair and consistent manner.

The teachers' responses to these eight items were combined to create the Safe and Orderly School scale. Students were then assigned to three groups based on the teachers' scale scores. Figure 3.6 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

At Year 4, students in *very* safe and orderly schools had a scale score of at least 9.9, which corresponded to teachers 'agreeing a lot' with four of the eight qualities of a safe and orderly school and 'agreeing a little' with the other four, on average. Students in *less than* safe and orderly schools had a scale score no higher than 6.8, which corresponded to teachers 'disagreeing a little' with four of the eight qualities and 'agreeing a little' with the other four, on average. All other students attended *somewhat* safe and orderly schools.

At Year 8, students in *very* safe and orderly schools had a scale score of at least 10.5, which corresponded to teachers 'agreeing a lot' with four of the eight qualities of a safe and orderly school and 'agreeing a little' with the other four, on average. Students in *less than* safe and orderly schools had a scale score no higher than 7.3, which corresponded to teachers 'disagreeing a little' with four of the eight qualities and 'agreeing a little' with the other four, on average. All other students attended *somewhat* safe and orderly schools.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.7 The Safe and Orderly School scale and student achievement in mathematics and science, Australia and the international averages

At Year 4, 64% of Australian students had mathematics teachers who reported that their schools were *very* safe and orderly; 28% were in *somewhat* safe and orderly schools; and 8% were in schools that were *less than* safe and orderly. In comparison, for the international averages, 61% of students had mathematics teachers who reported that their schools were *very* safe and orderly; 36% were in *somewhat* safe and orderly schools; and 4% had mathematics teachers who reported that their schools were *less than* safe and orderly.

At Year 4, 65% of Australian students had science teachers who reported that their schools were *very* safe and orderly; 26% were in *somewhat* safe and orderly schools; and 8% had science teachers who reported that their schools were *less than* safe and orderly. In comparison, for the international averages, 61% of students had science teachers who reported that their schools were *very* safe and orderly; 35% were in *somewhat* safe and orderly schools; and 4% had science teachers who reported that their schools were *less than* safe and orderly.

At Year 8, 59% of Australian students had mathematics teachers who reported that their schools were *very* safe and orderly; 35% were in *somewhat* safe and orderly schools; and 6% had mathematics teachers who reported that their schools were *less than* safe and orderly. In comparison, for the international averages, 48% of students had mathematics teachers who reported that their schools were *very* safe and orderly; 45% were in *somewhat* safe and orderly schools; and 6% had mathematics teachers who reported that their schools were *less than* safe and orderly.

At Year 8, 54% of Australian students had science teachers who reported that their schools were *very* safe and orderly; 37% were in *somewhat* safe and orderly schools; and 10% had science teachers who reported that their schools were *less than* safe and orderly. In comparison, for the international averages, 49% of students had science teachers who reported that their schools were *very* safe and orderly; 45% were in *somewhat* safe and orderly schools; and 6% had science teachers who reported that their schools were *less than* safe and orderly.

As can be seen in Figure 3.7, there is a clear relationship between students' achievement and teachers' reports about the safety and orderliness of their schools in Australia, with more safe and orderly schools associated with higher achievement (a correlation of around 0.18 at Year 4 and 0.26 at Year 8). The difference between the average achievement of Australian students whose teachers reported that their schools were *very* safe and orderly and students whose teachers reported that their schools were *less than* safe and orderly was between 38 points for Year 8 science and 63 points for Year 8 mathematics (the score difference was about 50 points for both subjects at Year 4). The differences between all groups were statistically significant for both subjects at both year levels, except for between *somewhat* safe and orderly schools and *less than* safe and orderly schools at Year 8. Internationally, on average, the gap was less than 15 points at Year 4 between the categories and around 40 points at Year 8.

Socioeconomic differences

Figure 3.8 presents the percentages of Australian students in each of the three categories of the Safe and Orderly School scale, according to school socioeconomic composition. It shows that, at both Year 4 and Year 8, students who attended *more affluent* schools were more likely to have teachers who reported that their schools were *very* safe and orderly, and less likely to have teachers who reported that their schools were *less than* safe and orderly than students who attended *more disadvantaged* schools.

At Year 4, 77% of students who attended *more affluent* schools had mathematics teachers who reported that their schools were *very* safe and orderly, compared to 64% of students at *neither more affluent nor more disadvantaged schools* and 39% of students who attended *more disadvantaged* schools. Conversely, 19% of students who attended *more disadvantaged* schools had mathematics teachers who reported that their schools were *less than* safe and orderly, compared to 3% of students at *neither more affluent nor more disadvantaged schools* and 1% of students who attended *more affluent* schools. The patterns of percentages were similar for science teachers.

At Year 8, 68% of students who attended *more affluent* schools had science teachers who reported that their schools were *very* safe and orderly, compared to 55% of students at *neither more affluent nor more disadvantaged schools* and 35% of students who attended *more disadvantaged* schools. Conversely, 18% of students who attended *more disadvantaged* schools had science teachers who reported that their schools were *less than* safe and orderly, compared to 8% of students at *neither more affluent nor more disadvantaged schools* and 5% of students who attended *more affluent* schools. The patterns of percentages were similar for mathematics teachers.

All of the differences between the *more affluent* schools and *more disadvantaged* schools were statistically significant, except for Year 8 mathematics teachers who reported that their schools were *less than* safe and orderly.

FIGURE 3.8 The Safe and Orderly School scale, in Australia, by school socioeconomic composition

3.5 Students' reports of bullying

Students' views of their personal safety at school were collected using items that focused on their experience of bullying behaviours.

Year 4 students were asked to indicate how often other students had done any of the following to them ('never', 'a few times a year', 'once or twice a month' or 'at least once a week'):

- ▶ teased me or called me names
- ▶ left me out of their games or activities
- ▶ spread lies about me
- ▶ stolen something from me
- ▶ damaged something of mine on purpose
- ▶ hit or hurt me (e.g. shoved, hit, kicked)
- ▶ made me do things I didn't want to do
- ▶ sent me nasty or hurtful messages online
- ▶ shared nasty or hurtful messages about me online
- ▶ shared embarrassing photos of me online
- ▶ threatened me.

The Student Bullying scale was created by combining the responses to these 11 items, and students were assigned to three groups based on their Student Bullying scale scores.

At Year 4, students bullied *never or almost never* had a scale score of at least 9.2, which corresponded to 'never' experiencing six of the 11 bullying behaviours and experiencing each of the other five behaviours 'a few times a year', on average. Students bullied *about weekly* had a scale score no higher than 7.4, which corresponded to their experiencing each of six of the 11 behaviours 'once or twice a month' and each of the other five 'a few times a year', on average. All other students were bullied *about monthly*.

Year 8 students were asked to indicate how often other students had done any of the following to them ('never', 'a few times a year', 'once or twice a month' or 'at least once a week'):

- ▶ said mean things about my physical appearance (e.g. my hair, my size)
- ▶ spread lies about me
- ▶ shared my secrets with others
- ▶ refused to speak to me
- ▶ insulted a member of my family
- ▶ stolen something from me
- ▶ made me do things I didn't want to do
- ▶ sent me nasty or hurtful messages online
- ▶ shared nasty or hurtful messages about me online
- ▶ shared embarrassing photos of me online
- ▶ threatened me
- ▶ physically hurt me
- ▶ excluded me from their group (e.g. parties, messaging)
- ▶ damaged something of mine on purpose.

The Student Bullying scale was created by combining the responses to these 14 items, and students were assigned to three groups based on their Student Bullying scale scores.

At Year 8, students bullied *never or almost never* had a scale score of at least 8.8, which corresponded to 'never' experiencing seven of the 14 bullying behaviours and experiencing each of the other seven behaviours 'a few times a year', on average. Students bullied *about weekly* had a scale score no higher than 7.2, which corresponded to their experiencing each of seven of the 14 behaviours 'once or twice a month' and each of the other seven 'a few times a year', on average. All other students were bullied *about monthly*.

Figure 3.9 presents the proportions of students in each of these categories, along with their average mathematics and science scores.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.9 The Student Bullying scale and student achievement in mathematics and science, Australia and the international averages

At Year 4, 54% of Australian students reported being bullied *never or almost never*; 39% had been bullied *about monthly*; and 7% reported being bullied *about weekly*. In comparison, for the international averages, 63% of students reported being bullied *never or almost never*; 29% had been bullied *about monthly*; and 8% reported being bullied *about weekly*.

At Year 8, 64% of Australian students reported being bullied *never or almost never*; 28% had been bullied *about monthly*; and 8% reported being bullied *about weekly*. In comparison, for the international averages, 71% of students reported being bullied *never or almost never*; 23% had been bullied *about monthly*; and 6% reported being bullied *about weekly*.

As can be seen in Figure 3.9, there is a small association between achievement and Australian students' experience of being bullied, with a lower experience of bullying associated with higher achievement (a correlation of around 0.13 at Year 4 and 0.14 at Year 8). The difference between the average achievement of Australian students who reported being bullied *never or almost never* and the average achievement of students who reported being bullied *about weekly* was between 50 and 55 points for both subjects at both year levels. The differences between all groups were statistically significant for both subjects at both year levels. Internationally, on average, the gap between being bullied *never or almost never* and being bullied *about weekly* was between 61 points for Year 4 mathematics and 78 points for Year 8 science.

Socioeconomic differences

Figure 3.10 presents the percentages of Australian students in each of the three categories of the Student Bullying scale, according to school socioeconomic composition. It shows that at Year 4 there was very little difference in the percentages of Australian students in each of the three categories of the Student Bullying scale across the socioeconomic groups. Slightly more than half of all students in each category had reported being bullied never or almost never, around 40% of students in each category had reported being bullied about monthly, while less than 10% had reported being bullied about weekly.

However, at Year 8, there were clear differences between the socioeconomic groups. Students who attended *more affluent* schools were more likely to report being bullied never or almost never, and less likely to report being bullied about weekly than students at *more disadvantaged* schools. That is, 69% of students who attended *more affluent* schools had reported being bullied never or almost never, compared to 65% of students at *neither more affluent nor more disadvantaged* schools and 57% of students at *more disadvantaged* schools. Conversely, 11% of students who attended *more disadvantaged* schools reported being bullied about weekly compared to 9% of students at *neither more affluent nor more disadvantaged* schools and 5% of students who attended *more affluent* schools.

There were no significant differences found at Year 4. At Year 8, all differences were significant, except for between students at *more affluent* schools and students at *neither more affluent nor more disadvantaged* schools in the percentage of students who reported being bullied about monthly.

FIGURE 3.10 The Student Bullying scale, in Australia, by school socioeconomic composition

3.6 Student absenteeism

Students were asked how often they were absent from school ('never or almost never', 'once every two months', 'once a month', 'once every two weeks' or 'once a week'). Figure 3.10 presents the percentages of Australian Year 4 and Year 8 students according to how often they were absent from school, along with their average achievement in mathematics and science.

Figure 3.11 shows that 57% of Australian Year 4 students were *never or almost never* absent from school, 18% were absent *once every two months*, 13% were absent *once a month*, 6% were absent *once every two weeks* and 7% were absent *once a week*. In comparison, for the international averages, 61% of Year 4 students were *never or almost never* absent from school, 13% were absent *once every two months*, 10% were absent *once a month*, 5% were absent *once every two weeks* and 11% were absent *once a week*.

At Year 8, 46% of Australian students were *never or almost never* absent from school, 23% were absent *once every two months*, 17% were absent *once a month*, 8% were absent *once every two weeks* and 5% were absent *once a week*. In comparison, for the international averages, 55% of Year 8 students were *never or almost never* absent from school, 16% were absent *once every two months*, 14% were absent *once a month*, 7% were absent *once every two weeks* and 8% were absent *once a week*.

As can be seen in Figure 3.11, at Year 4, Australian students who were *never or almost never* absent scored around 90 points higher in mathematics and around 80 points higher in science than those who were absent *once a week*. Australian Year 8 students who were *never or almost never* absent scored over 96 points higher in mathematics and 89 points higher in science than those who were absent *once a week*. Internationally, on average, this gap was over 60 points at Year 4 and around 90 points at Year 8.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.11 Frequency of student absences and student achievement in mathematics and science, Australia and the international averages

Socioeconomic differences

Figure 3.11 presents the percentages of Australian Year 4 and Year 8 students according to how often they were absent from school by school socioeconomic composition. At Year 8, there were no significant differences in the frequency of student absences across the socioeconomic groups. However, there were statistically significant differences at Year 4; 4% of students from *more affluent* schools reported being absent *once a week* compared with 7% of students from *neither more affluent nor more disadvantaged* schools, and 10% of students from *more disadvantaged* schools.

FIGURE 3.12 Frequency of student absences, in Australia, by school socioeconomic composition

3.7 Students feel tired

Students were asked how often they arrived at school feeling tired ('never', 'sometimes', 'every day or almost every day'). Figure 3.13 presents these data for Australian Year 4 and Year 8 students, along with average achievement in mathematics and science.

Fifty-three per cent of Australian Year 4 students reported being tired at school *sometimes* and a further 34% reported arriving at school tired *every day or almost every day*. These percentages were similar to the international averages. The average mathematics score of students who *never* or *sometimes* arrived at school tired was significantly higher than that of students who arrived at school tired *every day or almost every day*.

Forty-seven per cent of Australian Year 8 students reported being tired at school *sometimes* and a further 49% reported arriving at school tired *every day or almost every day*. These percentages were similar to the international averages. Students who arrived tired *every day or almost every day* also scored lower on average in both mathematics and science than students who arrived at school tired *sometimes*.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.13 Students report arriving at school feeling tired and student achievement in mathematics and science, Australia and the international averages

Socioeconomic differences

Figure 3.13 presents the percentages of Year 4 and Year 8 students according to how often they reported arriving at school feeling tired by school socioeconomic composition.

The percentage of students in Year 4 who arrived at school feeling tired varied slightly between *more affluent* schools and *more disadvantaged* schools – 36% of students in *more disadvantaged* schools and 37% of students from *neither more affluent nor more disadvantaged* schools reported arriving at school feeling tired every day or almost every day, compared to 30% of students from *more affluent* schools (a statistically significant difference). In Year 8, the percentages of students who arrived at school feeling tired did not vary greatly between students from schools of different socioeconomic composition.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.14 Students report arriving at school feeling tired, in Australia, by school socioeconomic composition

3.8 Students feel hungry

Students were also asked how often they arrived at school feeling hungry ('never', 'sometimes', 'every day or almost every day'). Figure 3.15 presents the percentages of Year 4 and Year 8 students according to how often they reported arriving at school feeling hungry, along with their average achievement in mathematics and science.

Unfortunately, 28% of Year 4 students and 27% of Year 8 students reported that they arrived at school feeling hungry *every day or almost every day*. This was the same as the international average for Year 4 students and 6 percentage points lower than the international average for Year 8 students. In Australia, in both Year 4 and Year 8, there was a relationship between how frequently students arrived at school feeling hungry and students' average mathematics achievement. Australian students who reported arriving at school feeling hungry *every day or almost every day* scored significantly lower, on average, than students who *never* arrived at school feeling hungry by between 43 points for Year 4 science and 54 points for Year 4 mathematics.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.15 Students report arriving at school feeling hungry and student achievement in mathematics and science, Australia and the international averages

Socioeconomic differences

Figure 3.16 presents the percentages of Year 4 and Year 8 students according to how often they arrived at school feeling hungry by school socioeconomic composition.

The percentage of Year 4 students who arrived at school feeling hungry varied between *more affluent* schools and *more disadvantaged* schools with 34% of students in *more disadvantaged* schools reporting that they arrived at school feeling hungry *every day or almost every day*, compared to 24% of students from *more affluent* schools. In Year 8, 31% of students in *more disadvantaged* schools arrived at school feeling hungry *every day or almost every day* compared to 23% of students in *more affluent* schools. These differences were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 3.16 Students report arriving at school feeling hungry, in Australia, by school socioeconomic composition

CHAPTER 4

MATHEMATICS TEACHER PREPARATION, PROFESSIONAL DEVELOPMENT AND JOB SATISFACTION

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- ▼ While almost all students were taught mathematics by teachers with at least a *bachelor degree or equivalent*, only 15% of Year 4 students and 22% of Year 8 students were taught by teachers with a *postgraduate university degree*, compared to 28% of Year 4 students and 35% of Year 8 students, on average, internationally.
- ▼ At Year 4, 80% of students were taught mathematics by teachers who *majored in primary education*, and a further 16% were taught mathematics by teachers who *majored in mathematics as well as primary education*.
- ▼ At Year 8, 77% of students were taught mathematics by teachers who majored in either or both mathematics and mathematics education, with the remaining 23% being taught by mathematics teachers who had not majored in either mathematics or mathematics education, and who could be considered to be teaching out-of-field.
- ▼ A higher percentage of Year 8 students from *more disadvantaged* schools than those in *more affluent* schools had mathematics teachers who had not majored in either mathematics or mathematics education.
- ▼ Mathematics teachers were asked about their need for future professional development opportunities in different topic areas. At both Year 4 and Year 8, the two most popular topics were *integrating technology into mathematics instruction* and *improving students' critical thinking or problem-solving skills*.
- ▼ At Year 4, 65% of students were taught by mathematics teachers who reported that they were *very satisfied* with their careers; whereas at Year 8, this percentage was 45%. There were no significant differences in mathematics achievement scores according to the level of teacher job satisfaction. However, at Year 8, students with teachers who reported they were *very satisfied* with their careers had significantly higher mathematics achievement scores than students whose teachers reported that they were *less than satisfied* with their careers.
- ▼ While there were no significant differences between the socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more affluent* schools than those who attended *more disadvantaged* schools had mathematics teachers who reported that they were very satisfied with their careers.
- ▼ While there were no significant differences according to the geographic location of schools at Year 4, a higher percentage of Year 8 students who attended schools in *regional and remote areas* than those who attended schools in *major cities* had mathematics teachers who reported that they were less than satisfied with their careers.

4.1 Introduction

Teacher effectiveness is considered to be one of the most important factors that can influence student learning (Darling-Hammond, 2017). It is influenced by teachers' levels of experience, efficacy and job satisfaction, and their access to high-quality professional development (Darling-Hammond et al., 2017; Klassen & Chiu, 2010; Podolsky et al., 2019). Further, effective teachers are those who can successfully manage student behaviour and foster student engagement (Lekwa et al., 2018; Stronge et al., 2011).

Teacher effectiveness can be measured in multiple ways, for instance, by asking students to evaluate their teachers' instructional clarity (Stronge et al., 2011). However, various factors in the classroom can also support or impede teacher effectiveness, for example, students' prior knowledge in the subject area. In Chapters 4 to 7 of this report, Australian data on the characteristics and experiences of students' mathematics and science teachers are presented as well as data on teacher practices and teacher perceptions of students' learning in these subjects.

This chapter focuses on the characteristics and experiences of Australian Year 4 and Year 8 students' mathematics teachers and draws on data collected in the TIMSS 2019 Teacher Questionnaire. Chapter 5 focuses on the teaching practices and factors in the classroom. Together, Chapters 4 and 5 present information on factors relating to mathematics teacher effectiveness for Australian Year 4 and Year 8 students.

As TIMSS focuses on student outcomes, results from the Teacher Questionnaire and the School Questionnaire are presented with regard to students. This means that each result is either reported as the percentage of students who attended schools that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 4 section of the Appendices.

4.2 Mathematics teachers' qualifications

Bachelor's and postgraduate degrees

Table 4.1 shows the percentages of Year 4 and Year 8 students according to their mathematics teachers' higher education qualification levels. The table shows the results for Australia and compares these with the international averages.

At Year 4, 82% of Australian students were taught mathematics by teachers who had *completed a bachelor's degree or equivalent but not a postgraduate degree* and a further 15% had mathematics teachers with a *postgraduate university degree* (i.e. doctorate, master's or other postgraduate degree). In comparison, on average across countries, only 56% of Year 4 students were taught mathematics by teachers who had *completed a bachelor's degree or equivalent* although a further 28% of students were taught mathematics by teachers with a *postgraduate university degree*.

At Year 8, 77% of Australian students were taught mathematics by teachers who had *completed a bachelor's degree or equivalent*, and an additional 22% of students had mathematics teachers with a *postgraduate university degree*. In comparison, on average across countries, 61% of students were taught mathematics by teachers who had *completed a bachelor's degree or equivalent* and 35% of students were taught mathematics by teachers with a *postgraduate university degree*.

TABLE 4.1 Year 4 and Year 8 mathematics teachers’ formal education, Australia and the international averages

	Percentages of students by their mathematics teachers’ educational level							
	Completed postgraduate university degree		Completed bachelor’s degree or equivalent but not a postgraduate degree*		Completed post-secondary education but not a bachelor’s degree		No further than upper-secondary education	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	15	2.4	82	2.5	3	1.1	0	0.0
International average	28	0.4	56	0.4	10	0.3	5	0.2
Year 8								
Australia	22	3.3	77	3.2	1	0.8	0	0.0
International average	35	0.5	61	0.5	3	0.2	2	0.1

Note: Due to rounding, totals may not add to 100%.
* This category includes teachers who completed a graduate diploma of education after completing an undergraduate degree.

Tertiary education majors or specialisation

In addition to reporting on teachers’ levels of education, the Teacher Questionnaire also investigated the major(s) or specialisation(s) that teachers undertook during their tertiary studies. Figure 4.1 presents these data. It shows the percentages of Australian Year 4 and Year 8 students with mathematics teachers who studied different types of major or specialisation related to mathematics teaching.

Sixteen per cent of Australian Year 4 students had mathematics teachers with a *major in primary education and mathematics* compared to the international average of 32%. Conversely, 80% of Australian Year 4 students had teachers who majored in *primary education but not mathematics*, which was 37% more than the international average.

There were no teachers of Year 4 Australian students who completed a *major or specialisation in mathematics but not primary education* compared with 11% for the international average while 4% of Australian students had teachers who had *other majors* compared to 8% for the international average.

At Year 8, 46% of Australian students had mathematics teachers who had a *major in mathematics and mathematics education*, which was just slightly higher than the international average of 39%. Seventeen per cent of Year 8 students had teachers who had a *major in mathematics education but not mathematics*. Only 14% of Australian students were taught by teachers who majored in *mathematics but not mathematics education* compared to the international average of 39% of students. However, 23% of Australian Year 8 students had mathematics teachers who had *other majors*, which was 13% more than the international average.

Note: Due to rounding, totals may not add to 100%.

FIGURE 4.1 Percentages of students by the type of major of mathematics teachers and student achievement in mathematics, Australia and the international averages

Socioeconomic differences

Figure 4.2 presents the percentages of Australian Year 4 and Year 8 students according to the type of major or specialisation of their mathematics teachers, but also presents these data according to the socioeconomic composition of the students' schools. The three levels of socioeconomic composition of the students' schools are *more affluent*, *neither more affluent nor more disadvantaged*, and *more disadvantaged*.

At Year 4, across the three levels of socioeconomic composition, the majority of students (more than 75%) had mathematics teachers with at least a major in primary education. Students from *more affluent* schools had the largest percentage of mathematics teachers with a major in both primary education and mathematics (22%), followed by 13% of students in *neither more affluent nor more disadvantaged schools*, and 18% in *more disadvantaged* schools. The percentages of students across schools from all three levels of socioeconomic composition who had mathematics teachers with other majors ranged from 1% to 6%. None of these differences were statistically significant.

The data presented a slightly different picture for Year 8. Students from *more disadvantaged* schools had a significantly lower percentage of mathematics teachers with a major in mathematics education and mathematics (31%) than students in *neither more affluent nor more disadvantaged schools* (51%) and *more affluent schools* (54%). Students from *more disadvantaged* schools and schools that were *neither more affluent nor more disadvantaged* had similar percentages of teachers who had neither a major in mathematics education nor mathematics (28% in *more disadvantaged schools* and 26% in *neither more affluent nor more disadvantaged schools*). This was higher than that found for students in *more affluent* schools (16%). The percentage gap difference between students from *more disadvantaged* schools and *more affluent* schools was statistically significant.

FIGURE 4.2 Percentages of students by the type of major of mathematics teachers, in Australia, by school socioeconomic composition

Geolocation differences

Figure 4.3 again presents the percentages of Australian Year 4 and Year 8 students according to the type of major or specialisation of their mathematics teachers, but breaks these data down according to the geographic locations of students' schools. The two geographic locations are schools in *major cities*, and students from schools in *regional and remote areas*.

At Year 4, the percentages of students being taught by teachers with each major or specialisation were similar across schools in *major cities* and schools in *regional and remote areas*.

At Year 8, the percentages of students being taught by mathematics teachers with a major in mathematics and mathematics education and mathematics teachers with a major in mathematics education but not mathematics were similar across schools in *major cities* and schools in *regional and remote areas*. A slightly higher percentage of students from schools in *major cities* were being taught mathematics by teachers who majored in mathematics but not education compared with students from schools in *regional and remote areas* (16% compared with 9%, respectively); however, this difference was not statistically significant.

FIGURE 4.3 Percentages of students by the type of major of mathematics teachers, in Australia, by school geographic location

4.3 Mathematics teachers' years of experience

The Teacher Questionnaire collected information on teachers' years of experience in the teaching profession. Table 4.2 presents the percentages of students in Year 4 and Year 8 according to how many years of experience their mathematics teachers had. The table shows the results for Australia and the international averages.

At Year 4, 31% of Australian students were taught by a mathematics teacher who had *20 years or more* of experience; 20% had mathematics teachers with *at least 10 but less than 20 years*; 25% had mathematics teachers with *at least 5 but less than 10 years*; and 24% of students were taught by mathematics teachers with *less than 5 years* of experience. The distribution of teachers in each of these categories for Australia shows similar percentages whereas the international average shows a greater percentage of Year 4 students had teachers who had worked for longer in the profession (*20 years or more* and *at least 10 but less than 20 years* categories). On average, Australian Year 4 mathematics teachers had 13 years of experience, compared to the international average of 17 years.

At Year 8, 31% of students were taught by mathematics teachers who had *20 years or more* of experience; 26% had mathematics teachers with *at least 10 but less than 20 years*; 19% were taught by mathematics teachers with *at least 5 but less than 10 years*; and 25% of students were taught by mathematics teachers with *less than 5 years* of experience. On average, Australian Year 8 mathematics teachers had 14 years of experience, compared to the international average of 16 years.

TABLE 4.2 Year 4 and Year 8 mathematics teachers' years of experience, Australia and the international averages

	Percentages of students by mathematics teachers' years of experience								Average years of experience as a teacher	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
Australia	31	3.4	20	2.4	25	3.1	24	3.5	13	0.8
International average	41	0.5	29	0.4	15	0.4	14	0.4	17	0.1
Year 8										
Australia	31	3.2	26	3.0	19	2.6	25	2.6	14	0.8
International average	35	0.5	33	0.6	18	0.5	14	0.4	16	0.1

Note: Due to rounding, totals may not add to 100%.

Socioeconomic differences

Table 4.3 shows the percentages of students in Year 4 and Year 8 according to the experience of their mathematics teachers and also differentiates these data according to the socioeconomic composition of students' schools.

At Year 4, the percentages of students with teachers who reported each category of experience was similar across all socioeconomic school groupings, as was the average years of experience.

At Year 8, the pattern was mostly similar; however, the percentage of students from *neither more affluent nor more disadvantaged* schools who had teachers with 20 years or more experience (24%) was significantly lower than the percentage for students from *more affluent* schools (43%). Any other differences were not statistically significant.

TABLE 4.3 Australian Year 4 and Year 8 mathematics teachers' years of experience, by school socioeconomic composition

	Percentages of students by mathematics teachers' years of experience								Average years of experience as a teacher	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
More affluent	33	6.6	24	5.0	24	6.1	20	5.9	14	1.4
Neither more affluent nor more disadvantaged	26	5.0	21	4.7	28	6.0	25	5.5	12	1.1
More disadvantaged	34	6.8	16	3.9	23	5.7	27	7.5	14	1.7
Year 8										
More affluent	43	7.1	21	4.7	15	4.2	20	4.5	17	1.6
Neither more affluent nor more disadvantaged	24	5.0	30	5.9	24	4.9	23	4.7	13	1.2
More disadvantaged	29	5.8	25	5.7	20	5.8	26	5.5	14	1.6

Note: Due to rounding, totals may not add to 100%.

Geolocation differences

Table 4.4 shows the percentages of students in Year 4 and Year 8 according to the experience of their mathematics teachers and the geographic location of their schools.

For both Year 4 and Year 8, the percentages of students taught by teachers with different years of experience were similar across schools in *major cities* and schools in *regional and remote areas* with any differences observed being small and not statistically significant.

TABLE 4.4 Australian Year 4 and Year 8 mathematics teachers' years of experience, by school geographic location

		Percentages of students by mathematics teachers' years of experience								Average years of experience as a teacher	
		20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
		Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4											
Major cities	31	4.0	18	2.6	27	3.9	25	4.3	13	1.0	
Regional and remote areas	33	6.0	27	5.5	17	5.5	23	5.0	15	1.4	
Year 8											
Major cities	33	4.1	22	3.5	19	3.4	25	3.1	15	1.0	
Regional and remote areas	26	4.9	33	5.3	17	3.7	23	4.7	14	1.2	

Note: Due to rounding, totals may not add to 100%.

4.4 Mathematics teachers' participation in professional development

One way to ensure and improve teacher effectiveness is through teacher participation in professional development (PD). This was investigated in the Teacher Questionnaire. Figure 4.4 presents the percentages of Year 4 and Year 8 students whose mathematics teachers reported participating in various forms of PD in the past two years. Teachers' attendance at PD is influenced by multiple factors such as the availability of particular courses to teachers and schools, school funding, school or systemic requirements as well as opportunity or time and teacher interest.

At Year 4 in Australia, 56% of students were taught mathematics by teachers who had participated in PD on mathematics content in the past two years. The next most attended topics were *improving students' critical thinking or problem-solving skills* (55%), *mathematics pedagogy/instruction* (54%), *mathematics curriculum* (53%), *addressing individual students' needs* (52%), *mathematics assessment* (43%) and *integrating technology into mathematics instruction* (30%). The percentages of students whose mathematics teachers attended PD were generally higher in Australia compared to the international average. The greatest differences were in two topics. There was a 12 percentage point difference between Australia (53%) and the international average (41%) in the *mathematics curriculum* topic and an 11 percentage point difference between Australia (55%) and the international average (44%) in the *improving students' critical thinking or problem-solving skills* topic.

At Year 8 in Australia, there was an emphasis on *mathematics curriculum* and *mathematics pedagogy/instruction* where 63% of students were taught by mathematics teachers who had attended PD on these topics. *Addressing individual students' needs* was another popular topic where 60% of students had mathematics teachers who attended PD in this area. Other topics with strong uptakes were *improving students' critical thinking or problem-solving skills* and *mathematics content* (both 58%), *integrating information technology into mathematics instruction* (55%) and *mathematics assessment* (52%). Internationally, the percentages of students who had mathematics teachers who attended PD on any

particular topic were similar to Australia's. However, the percentages of students who had mathematics teachers who attended PD in *mathematics curriculum*, *improving students' critical thinking or problem-solving skills*, and *addressing individual students' needs* was higher in Australia than internationally, with the greatest difference (16 percentage points) for *addressing individual students' needs*.

Note: Due to rounding, totals may not add to 100%.

FIGURE 4.4 Percentages of students by mathematics teachers' area of professional development, Australia and the international averages

Mathematics teachers' professional development needs

To complement data on participation in PD, the Teacher Questionnaire also asked teachers about their need for future PD opportunities in different topic areas.

Figure 4.5 presents the percentages of Year 4 and Year 8 students whose mathematics teachers reported needing various forms of PD in the future. These data were less likely to be influenced by factors that might have impacted their previous attendance at PD (e.g. funding and availability etc.) and were more likely to reflect teachers' interest in furthering their knowledge and understanding on particular topic areas.

The most desired topic for Australia and the international averages was *integrating technology into mathematics instruction*; 78% of Australian students were taught by teachers who reported interest in this area and 72% was the international average. Interestingly, this topic was also the one that was the least attended over the last two years – only 30% of Year 4 students were taught mathematics by teachers who participated in PD on *integrating technology into mathematics instruction*. The second most requested topic was *improving students' critical thinking or problem-solving skills* (76%) where only 55% of Year 4 students were taught by teachers who had undertaken PD on this topic. The format of the Teacher Questionnaire allowed teachers to respond freely to both questions assessing teachers attended PD as well future PD needs. This means that a teacher could have responded that they attended PD on a particular topic in the last two years and then also responded that they wanted to do further training on this same topic in the future.

Note: Due to rounding, totals may not add to 100%.

FIGURE 4.5 Percentages of students by mathematics teachers' needs for future professional development, Australia and the international averages

The next most popular topics for future PD were *addressing individual students' needs* and *mathematics assessment* (both 63%), *mathematics pedagogy/instruction* (54%), *mathematics content* (43%), and *mathematics curriculum* (40%). The international average for each topic area was relatively similar to the percentage found for Australia except for *mathematics assessment* where 63% of Australian students' teachers expressed a need for PD compared with 54% on average across countries.

A large percentage of Year 8 students were taught by teachers who expressed interest in future PD, which ranged from 58% to 84% across the different areas. The most requested topics were *improving students' critical thinking or problem-solving skills* and *integrating technology into mathematics instruction* where 84% and 81% of students, respectively, were taught by teachers who reported wanting PD in these areas. Further, for the topics *integrating technology into mathematics instruction* and *improving students' critical thinking or problem-solving skills*, only 55% and 58% of students, respectively, had teachers who attended PD in these areas in the last two years.

The next most requested topics for future PD were *addressing individual students' needs* (77%), *mathematics assessment* (71%), *mathematics pedagogy/instruction* (70%), followed by *mathematics curriculum* (61%) and *mathematics content* (58%). There was some variation between the percentages of Australian students being taught by mathematics teachers who requested PD on specific areas and the international averages, particularly for the topics *improving students' critical thinking or problem-solving skills* (84% for Australian students' teachers and 69% for the international average) and *mathematics assessment* (71% for Australian students' teachers and 57% for the international average).

4.5 Mathematics teachers' job satisfaction

Teachers' satisfaction with their careers can impact their wellbeing and students' attitudes towards school and learning. Job satisfaction can also be associated with teacher efficacy and therefore is an area of interest when investigating teacher effectiveness.

Teachers were asked to indicate how often ('very often', 'often', 'sometimes' or 'never or almost never') they agreed with the following statements:

- ▶ I am content with my profession as a teacher.
- ▶ I find my work full of meaning and purpose.

- I am enthusiastic about my job.
- My work inspires me.
- I am proud of the work I do.

Teachers' responses to these five items were combined to create the Teacher Job Satisfaction scale. Students were then assigned to three groups based on their teachers' scale scores.

At Year 4, students with *very satisfied* mathematics teachers had a scale score of at least 10.1, which corresponded to teachers responding 'very often' to three of the five statements and responding 'often' to the other two, on average. Students with *less than satisfied* teachers had a scale score no higher than 6.5, which corresponded to teachers responding 'sometimes' to three of the five statements and 'often' to the other two, on average. All other students had *somewhat satisfied* teachers.

At Year 8, students with *very satisfied* mathematics teachers had a scale score of at least 10.2, which corresponded to teachers responding 'very often' to three of the five statements and responding 'often' to the other two, on average. Students with *less than satisfied* mathematics teachers had a scale score no higher than 6.8, which corresponded to teachers responding 'sometimes' to three of the five statements and 'often' to the other two, on average. All other students had *somewhat satisfied* teachers.

Figure 4.6 presents the proportions of students in Year 4 and Year 8 for each of these categories, according to their mathematics teachers' responses.

For Year 4, 65% of Australian students were taught by mathematics teachers who reported that they were *very satisfied* with their careers; 29% of students had teachers who reported that they were *somewhat satisfied*; and 6% of students had teachers who reported that they were *less than satisfied*. The international averages were similar in each of these three categories. There were also no significant differences found between mathematics achievement scores according to the level of job satisfaction reported by students' teachers for Australia at Year 4.

At Year 8, 45% of Australian students had mathematics teachers who reported that they were *very satisfied* with their careers, while 46% of students had teachers who reported that they were *somewhat satisfied* and 9% had teachers who reported that they were *less than satisfied*. In comparison, the international average for the percentage of teachers who reported being *very satisfied* was 54% compared to 45% for Australia, and the international average for the *somewhat satisfied* category was 39% compared to 46% for Australia.

Australian Year 8 students with teachers who reported that they were *very satisfied* with their careers had significantly higher mathematics achievement scores than students whose teachers reported that they were *less than satisfied* with their careers.

FIGURE 4.6 The Mathematics Teacher Job Satisfaction scale and student achievement in mathematics, Australia and the international averages

Socioeconomic differences

Figure 4.7 presents the proportions of Year 4 and Year 8 students in each of the teacher job satisfaction categories according to the socioeconomic composition of their schools.

At Year 4, across each category of school socioeconomic composition, the percentages of students with teachers who reported that they were less than, somewhat or very satisfied with their teaching career were generally similar. Any differences were small and not statistically significant.

At Year 8, results were more varied. There was a significantly higher percentage of students from *more affluent* schools (57%) with mathematics teachers who reported being very satisfied with their careers than there were at *more disadvantaged schools* (32%). There was also a significantly higher percentage of students at *more disadvantaged schools* (59%) with mathematics teachers who were somewhat satisfied with their teaching careers than there were at *more affluent* and *neither more affluent nor more disadvantaged schools* (both 40%). Finally, there was a significantly higher percentage of students at *neither more affluent nor more disadvantaged schools* (19%) with mathematics teachers who were less than satisfied with their careers than there were at *more affluent* schools (3%).

Note: Due to rounding, totals may not add to 100%.

FIGURE 4.7 The Mathematics Teacher Job Satisfaction scale, in Australia, by school socioeconomic composition

Geolocation differences

Figure 4.8 presents the proportions of Year 4 and Year 8 students in each of the teacher job satisfaction categories according to the geographic location of their schools.

At Year 4, results for the Teacher Job Satisfaction scale varied slightly for the teachers of students from schools in *major cities* compared to the teachers of students from schools in *regional and remote areas*; however, any differences observed were not statistically significant.

At Year 8, there was a significantly higher percentage of students from schools in *regional and remote areas* with mathematics teachers who reported being less than satisfied with their teaching careers (16%) than there were at schools in *major cities* (6%). No other differences were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 4.8 The Mathematics Teacher Job Satisfaction scale, in Australia, by school geographic location

CHAPTER 5

TEACHING MATHEMATICS

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- ▼ 74% of Year 4 students and 40% of Year 8 students reported *high clarity of instruction* in their mathematics lessons. These students had higher achievement in mathematics than those who reported *low clarity of instruction*.
- ▼ While there were no significant differences between socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more affluent* schools than those who attended *more disadvantaged* schools reported high clarity of instruction in their mathematics lessons.
- ▼ At Year 4, 71% of students had *computers available for use* in mathematics lessons, while in Year 8 the proportion was slightly larger at 76%. At Year 8, access to computers during mathematics lessons was associated with significantly higher achievement in mathematics than not having access.
- ▼ 17% of Year 4 students and 24% of Year 8 students reported disorderly behaviour in *most lessons*. Students who reported disorderly behaviour in *few or no lessons* had higher achievement in mathematics than students who reported disorderly behaviour in *most lessons*.
- ▼ While there were no significant differences between socioeconomic groups at Year 4, a higher percentage of Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools reported disorderly behaviour in most lessons.
- ▼ Around 25% of Year 4 and Year 8 students were taught mathematics by teachers who reported that their teaching was limited *very little* by students not ready for instruction, with around 65% taught by mathematics teachers who reported that their teaching was limited *some*. Students whose mathematics teachers reported that their teaching was limited *very little* had higher achievement in mathematics than students whose mathematics teachers reported that their teaching was limited *a lot*.
- ▼ A higher percentage of Year 4 and Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools had mathematics teachers who reported that their teaching was limited a lot by students not ready for instruction.

5.1 Introduction

Chapter 4 presented data on Australian students' Year 4 and Year 8 mathematics teachers in terms of their characteristics and experiences. Chapter 5 focuses on the teaching practices and factors in the classroom that can support or obstruct effective mathematics teaching as collected in the TIMSS 2019 Student Questionnaire and the Teacher Questionnaire. Together, Chapters 4 and 5 present information on factors relating to mathematics teacher effectiveness for Australian Year 4 and Year 8 students.

As TIMSS focuses on student outcomes, results from the Teacher Questionnaire and the School Questionnaire are presented with regard to students. This means that each result is either reported as the percentage of students who attended a school that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 5 section of the Appendices.

5.2 Instructional time in mathematics

Instructional time in mathematics classes is likely to impact on students' mathematical learning. Using TIMSS data derived from teachers' reports of weekly instructional time for mathematics and principals' reports of how many days the school is open for instruction (weekly and yearly), it was possible to estimate the average hours per year that Australian students received in mathematics instruction.

In Australia for Year 4 mathematics, the average time spent on instruction was 190 hours per year. The international average was 154 hours per year. There was variation in the hours of instruction time for other countries that participated in TIMSS 2019. Portugal reported 250 hours per year and was the country with the highest instruction time. Singapore had an average of 211 hours, the United States 210 hours, Northern Ireland 203 hours, Canada 198 hours, Ireland 165 hours, New Zealand 160 hours and Hong Kong 152 hours per year. Korea was the country with the lowest amount of instruction time with 101 hours.

At Year 8, in Australia, the average time spent on mathematics instruction was 141 hours per year. Internationally, the average was 137 hours per year. Chile reported the greatest amount of time, with 200 hours per year. The United States had an average of 154 hours, Hong Kong 143 hours, New Zealand 137 hours, Singapore 135 hours and Ireland 108 hours per year. Cyprus was the country with the lowest amount of instruction time with 102 hours per year.

5.3 Coverage of TIMSS mathematics topics

Teachers were asked whether the students in the participating TIMSS class had been taught each of the TIMSS topics mostly before or during the year of assessment. Table 5.1 shows the TIMSS topics for mathematics at both Year 4 and Year 8 levels according to the content domains. Figure 5.1 shows the percentages of Year 4 and Year 8 students who had been taught the TIMSS topics, on average, for each content domain. The figure shows the results for Australia and the international averages.

Eighty-nine per cent of Australian Year 4 students had been taught all of the TIMSS mathematics topics before or during Year 4. Across the domains, this percentage ranged from 84% for *measurement and geometry* to 93% for *number*. Internationally, the percentage of Year 4 students who had been taught the TIMSS topics was lower than for Australia in each domain, particularly in relation to *data* where 92% of Australian students had been taught this content compared to 78% for the international average.

At Year 8, 72% of Australian students had been taught all of the TIMSS mathematics topics before or during Year 8. Across the four domains, this percentage ranged from 60% for *algebra* to 97% for *number*. Internationally, the percentage of Year 8 students who had been taught the TIMSS topics was similar to that of Australia in *number* and *geometry*, lower than Australian students in *data and probability* but higher than Australia in *algebra*.

TABLE 5.1 The TIMSS mathematics topics at Year 4 and Year 8

Year 4	
Content domains	Topic areas
<i>Number</i>	<ul style="list-style-type: none"> ▶ Concepts of whole numbers, including place value and ordering ▶ Adding, subtracting, multiplying and dividing with whole numbers ▶ Concepts of multiples and factors; odd and even numbers ▶ Number sentences (finding the missing number, representing problem situation with number sentences) ▶ Number patterns (extending number patterns and finding missing terms) ▶ Concepts of fractions, including representing, comparing, and ordering, adding and subtracting simple fractions ▶ Concepts of decimals, including place value and ordering, adding and subtracting with decimals
<i>Measurement and geometry</i>	<ul style="list-style-type: none"> ▶ Solving problems involving length, including measuring and estimating ▶ Solving problems involving mass, volume and time ▶ Finding and estimating perimeter, area and volume ▶ Parallel and perpendicular lines ▶ Comparing and drawing angles ▶ Elementary properties of common geometric shapes ▶ Three-dimensional shapes, including relationships with their two-dimensional representations
<i>Data</i>	<ul style="list-style-type: none"> ▶ Reading and interpreting data from tables, pictographs, bar graphs, line graphs and pie charts ▶ Organising and representing data to help answer questions ▶ Drawing conclusions from data displays
Year 8	
Content domains	Topic areas
<i>Number</i>	<ul style="list-style-type: none"> ▶ Computing with negative numbers ▶ Concepts of fractions and decimals ▶ Solving problems involving proportions and percentages
<i>Algebra</i>	<ul style="list-style-type: none"> ▶ Simplifying and evaluating algebraic expressions ▶ Simple linear equations ▶ Simple linear inequalities ▶ Simultaneous (two variables) equations ▶ Representation of linear and quadratic functions in tables, graphs, words or equations ▶ Properties of functions (slopes, intercepts etc.) ▶ Numeric, algebraic, and geometric patterns or sequences (extension, missing terms, generalisation of patterns)
<i>Geometry</i>	<ul style="list-style-type: none"> ▶ Geometric properties of angles, pair of lines and geometric shapes (triangles, quadrilaterals and other common polygons) ▶ Solving problems involving perimeters, circumferences, and areas ▶ Solving problems involving the Pythagorean Theorem ▶ Translation, reflection and rotation ▶ Congruent figures and similar triangles ▶ Solving problems with three-dimensional shapes
<i>Data and probability</i>	<ul style="list-style-type: none"> ▶ Reading and interpreting data from one or more sources to solve problems (interpolating, extrapolating, drawing conclusions) ▶ Identifying appropriate procedures for collecting data ▶ Organising and representing data to help answer questions ▶ Calculating and interpreting statistics summarising data distributions ▶ Theoretical and empirical probability of simple events ▶ Theoretical and empirical probability of compound events

Note: Due to rounding, totals may not add to 100%.

FIGURE 5.1 Percentages of students taught the TIMSS mathematics topics, Australia and the international averages

5.4 Instructional clarity in mathematics lessons

The degree to which teachers are clear in the way they deliver the mathematics curriculum is likely to influence student learning. Students were asked to indicate their level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements about instructional clarity in their mathematics lessons:

- ▶ I know what my teacher expects me to do.
- ▶ My teacher is easy to understand.
- ▶ My teacher has clear answers to my questions.
- ▶ My teacher is good at explaining mathematics.
- ▶ My teacher does a variety of things to help us learn.
- ▶ My teacher links new lessons to what I already know. (Year 8 only)
- ▶ My teacher explains a topic again when we don't understand.

Students' responses to these seven items were combined to create the Instructional Clarity in Mathematics Lessons scale. Students were then assigned to groups based on their scale scores.

At Year 4, students who reported *high clarity of instruction* had a scale score of at least 8.7, which corresponded to their 'agreeing a lot' to three of the six statements and 'agreeing a little' to the other three, on average. Students who reported *low clarity of instruction* had a scale score no higher than 6.8, which corresponded to their 'disagreeing a little' to three of the six statements and 'agreeing a little' to the other three, on average. All other students reported *moderate clarity of instruction* in their mathematics lessons.

At Year 8, students who reported *high clarity of instruction* had a scale score of at least 10.3, which corresponded to their 'agreeing a lot' to four of the seven statements and 'agreeing a little' to the other three, on average. Students who reported *low clarity of instruction* had a scale score no higher than 7.8, which corresponded to their 'disagreeing a little' to four of the seven statements and 'agreeing a little' to the other three, on average. All other students reported *moderate clarity of instruction* in their mathematics lessons.

Figure 5.2 presents the percentages of Australian Year 4 and Year 8 students in the clarity of instruction categories, along with their average achievement in mathematics. It shows that 74% of Year 4 students in Australia reported *high clarity of instruction* in their mathematics lessons, in contrast to 21% of students who reported *moderate clarity of instruction* and 5% of students who reported *low clarity of instruction*. These percentages were the same as the corresponding international averages.

Note: Due to rounding, totals may not add to 100%.

FIGURE 5.2 The Instructional Clarity in Mathematics scale and student achievement in mathematics, Australia and the international averages

At Year 8, 40% of students in Australia reported *high clarity of instruction* in their mathematics lessons, which was six percentage points lower than the international average. The Australian and international averages were nearly same for *moderate clarity of instruction* (42% and 41%, respectively) and Australia was 5 percentage points higher than the international average for *low clarity of instruction*.

Figure 5.2 also illustrates a pattern between reported clarity of instruction in the mathematics classroom and mathematics achievement. At Year 4, Australian students who reported *high clarity of instruction* scored 49 points higher than those who reported *low clarity of instruction* in their mathematics lessons. In Year 8, Australian students who reported *high clarity of instruction* in their mathematics lessons scored over 50 points higher than those who reported *low clarity of instruction* in their mathematics lessons. All differences in achievement were statistically significant. Internationally, on average, the gap between students who reported *high clarity* and *low clarity of instruction* was just over 40 points at Year 4 and 37 points at Year 8.

Socioeconomic differences

Figure 5.3 presents the percentages of Australian Year 4 and Year 8 students in each of the instructional clarity categories, by school socioeconomic composition. It shows that at Year 4, the percentage of students in each instructional clarity category were similar across all three levels of school socioeconomic composition. However, there were significant differences at Year 8, with 47% of students from *more affluent* schools reporting high clarity of instruction in their mathematics lessons compared with 35% of students from *neither more affluent nor more disadvantaged schools* and 36% from *more disadvantaged* schools.

Note: Due to rounding, totals may not add to 100%.

FIGURE 5.3 The Instructional Clarity in Mathematics scale, in Australia, by school socioeconomic composition

5.5 Technology in mathematics instruction

Technology has become a regular component of mathematics classrooms in primary and secondary schools for many countries. In the Teacher Questionnaire, teachers were asked about their use of computers while teaching mathematics and the frequency with which they used technology to support student learning.

Computer access for instruction

Teachers were asked about their use of computers while teaching mathematics to the TIMSS students. Table 5.2 presents the percentages of Year 4 and Year 8 students, for Australia and internationally, who had access to computers during mathematics classes and the type of access (individual or shared), as reported by teachers. Achievement data are also presented.

At Year 4, 71% of Australian students had computers available to use in mathematics lessons, while in Year 8 the proportion was slightly larger at 76%. These percentages were higher than the corresponding international averages by over 30 percentage points for each year level.

In Year 4, there were only small differences in average mathematics achievement between students who had access to computers during mathematics lessons and those who did not. However, in Year 8, access to computers during mathematics lessons was associated with significantly higher achievement. Internationally, on average across countries, in both Year 4 and Year 8, there were statistically significant differences in the average mathematics achievement between students who had access to computers during mathematics lesson and those who did not. Those who had access scored significantly higher.

TABLE 5.2 Computer access during mathematics lessons and student achievement in mathematics, Australia and the international averages

	Computers available for students to use during mathematics lessons						Percentages of students by computer access*					
	Students (%)		Mathematics achievement				Each student has a computer		The class has computers that students can share		The school has computers that the class can sometimes use	
	Yes		Yes		No							
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4												
Australia	71	3.5	521	3.9	511	7.0	32	3.2	39	3.8	44	4.0
International average	39	0.4	506	1.4	500	0.7	13	0.3	17	0.4	29	0.4
Year 8												
Australia	76	2.9	529	4.9	488	8.2	62	2.9	10	2.1	40	3.3
International average	37	0.5	495	1.3	487	0.9	17	0.4	11	0.4	28	0.5

Note: Due to rounding, totals may not add to 100%.

* Teachers could indicate the class having more than one type of computer access.

Technology to support learning

The Teacher Questionnaire also collected data on the frequency with which teachers reported using computers to support learning during mathematics lessons.

At Year 4, 14% of Australian students had teachers who reported using technology to support learning *every day or almost every day*, 37% of students had teachers who reported *once or twice a week* (compared to 14% for the international average), and 11% of students had teachers who reported *once or twice a month*. While 38% of Australian students had teachers who reported *never or almost never* using computers to support learning, the international average for this category was 67%.

Across countries there was a wide range in the percentages of Year 4 students with teachers who reported using technology to support learning in mathematics lessons at least once a month. Most students in Georgia (97%) had teachers who reported using technology at least once a month compared to only 4% in Pakistan. In England, the percentage was 28%; in Ireland it was 34%; Singapore 41%; Canada 48%; Northern Ireland and Australia 62%; the United States 72%; and in New Zealand it was 82%.

At Year 8, an average of 25% of Australian students were in classes in which their teachers reported using technology to support learning *every day or almost every day*, 27% of students had teachers who reported *once or twice a week*, 18% of students had teachers who reported *once or twice a month* and 30% of students had teachers who reported *never or almost never*. These percentages were higher than the international averages, with the exception of the *never or almost never* category where 68% of students compared to 30% of Australian students had teachers who reported this frequency of use.

There was also a wide range across countries in the percentage of Year 8 students with teachers who reported using technology to support learning in mathematics lessons at least once a month. Most students in Georgia (83%) had teachers who reported using technology at least once a month compared to only 4% in Morocco. In England, the percentage was 20%; in Ireland it was 21%; Singapore 28%; the United States 67%; Australia 70%, and in New Zealand it was 78%.

5.6 Disorderly behaviour during mathematics lessons

Disorderly behaviour in class can disrupt student learning. Students were asked to indicate the frequency with which the following things happened during their mathematics lessons ('never', 'some lessons', 'about half the lessons' or 'every or almost every lesson'):

- ▶ Students don't listen to what the teacher says.
- ▶ There is disruptive noise.
- ▶ It is too disorderly for students to work well.
- ▶ My teacher has to wait a long time for students to quiet down.
- ▶ Students interrupt the teacher.
- ▶ My teacher has to keep telling us to follow the classroom rules.

Students' responses to these six items were combined to create the Disorderly Behaviour During Mathematics Lessons scale. Students were then assigned to groups based on their scale scores.

At Year 4, students who reported disorderly behaviour in *few or no lessons* had a score on the scale of at least 11.6, which corresponded to their reporting that three of the six situations 'never' happened and the other three happened in 'some lessons', on average. Students who reported disorderly behaviour in *most lessons* had a scale score of at least 8.0, which corresponded to their reporting that three of the six situations happened in 'every or almost every lesson' and the other three happened in 'about half the lessons', on average. All other students reported disorderly behaviour in *some lessons*.

At Year 8, students who reported disorderly behaviour in *few or no lessons* had a scale score of at least 11.6, which corresponded to their reporting that three of the six situations 'never' happened and the other three happened in 'some lessons', on average. Students who reported disorderly behaviour in *most lessons* had a score on the scale of at least 7.9, which corresponded to their reporting that three of the six situations happened in 'every or almost every lesson' and the other three happened in 'about half the lessons', on average. All other students reported disorderly behaviour in *some lessons*.

Figure 5.4 presents the percentages of Australian Year 4 and Year 8 students in each of these categories, along with their average achievement in mathematics.

At Year 4, 76% of Australian students reported disorderly behaviour in *some lessons* and 17% in *most lessons*. Seven per cent of students reported disorderly behaviour in *few or no lessons*. In comparison, for the international averages, 68% of Year 4 students reported disorderly behaviour in *some lessons*, 14% in *most lessons* and 18% in *few or no lessons*.

At Year 8, 65% of Australian students reported disorderly behaviour in *some lessons* and 24% in *most lessons*. Eleven per cent of students reported disorderly behaviour in *few or no lessons*. In comparison, for the international averages, 65% of Year 4 students also reported disorderly behaviour in *some lessons*, 13% in *most lessons* and 21% in *few or no lessons*.

In both Year 4 and Year 8, Japan had the highest percentages of students who reported disorderly behaviour in *few or no lessons* (41% and 60%) and the lowest percentages of students who reported disorderly behaviour in *most lessons* (5% and 2%). At Year 8, Australia was one of 16 countries where less than 20% of students reported disorderly behaviour in *few or no lessons*, along with Canada and New Zealand. Australia was one of 13 countries where less than 10% of Year 4 students reported disorderly behaviour in *few or no lessons*, along with England and New Zealand.

Internationally and in Australia, there were similar patterns between the reported frequency of disorderly behaviour and average student achievement in mathematics. In Australia, Year 4 students who reported disorderly behaviour in *few or no lessons* had an average score of 542, which was 20 points higher than the average for students who reported disorderly behaviour in *some lessons* and 63 points higher

than the average for students who reported this behaviour in *most lessons*. Similarly, Year 8 students who reported disorderly behaviour in *few or no lessons* had an average score of 565, which was 45 points higher than the average for students who reported disorderly behaviour in *some lessons* and 72 points higher than the average for students who reported this behaviour in *most lessons*. These differences were all statistically significant.

FIGURE 5.4 The Disorderly Behaviour During Mathematics Lessons scale and student achievement in mathematics, Australia and the international averages

Socioeconomic differences

Figure 5.5 presents the percentages of Australian Year 4 and Year 8 students in each of the disorderly behaviour categories and by school socioeconomic composition. It shows that at both Year 4 and Year 8, higher percentages of students reported disorderly behaviour in *some lessons* irrespective of the socioeconomic composition of their schools.

At Year 4, there was a similar pattern in the frequency of disorderly behaviour reported across all school socioeconomic groups.

At Year 8, 32% of students from *more disadvantaged* schools reported disorderly behaviour in most lessons compared to 16% of students in *more affluent* schools. There was a 10 percentage point difference between students from *more affluent* schools who reported disorderly behaviour in few or no lessons compared with students from *more disadvantaged* schools. This difference was statistically significant.

FIGURE 5.5 The Disorderly Behaviour During Mathematics Lessons scale, in Australia, by school socioeconomic composition

5.7 Mathematics teaching limited by students not ready for instruction

Teachers of the Year 4 and Year 8 classes that undertook TIMSS 2019 were asked their opinion on the extent to which instruction at their school was limited ('a lot', 'some' or 'not at all') by the following student attributes:

- ▶ students lacking prerequisite knowledge or skills
- ▶ students suffering from lack of basic nutrition
- ▶ students suffering from not enough sleep
- ▶ students absent from class
- ▶ disruptive students
- ▶ uninterested students
- ▶ students with mental, emotional or psychological impairment
- ▶ students with difficulties understanding the language of instruction.

Teachers' responses to these eight items were combined to create the Classroom Teaching Limited by Students Not Ready for Instruction scale. Students were then assigned to groups based on their mathematics teachers' scale scores.

At Year 4, students with mathematics teachers who felt their teaching was limited *very little* had a scale score of at least 10.8, which corresponded to their teachers feeling they were 'not at all' limited by four of the eight attributes and to 'some' extent limited by the other four, on average. Students with teachers who felt their teaching was limited *a lot* had a scale score no higher than 6.8, which corresponded to their feeling limited 'a lot' by four of the eight attributes and to 'some' extent limited by the other four, on average. All other students had teachers who felt their teaching was limited somewhat (*some*).

At Year 8, students with mathematics teachers who felt their teaching was limited *very little* had a scale score of at least 11.2, which corresponded to teachers feeling 'not at all' limited by four of the eight attributes and to 'some' extent limited by the other four, on average. Students with teachers who felt their teaching was limited *a lot* had a scale score no higher than 7.2, which corresponded to teachers reporting feeling limited *a lot* by four of the eight attributes and to *some* extent limited by the other four, on average. All other students had teachers who felt their teaching was limited somewhat (*some*).

FIGURE 5.6 The Mathematics Classroom Teaching Limited by Students Not Ready for Instruction scale and student achievement in mathematics, Australia and the international averages

Figure 5.6 presents the percentages of Australian Year 4 and Year 8 students in each of these categories, along with their average achievement in mathematics.

At Year 4, 24% of Australian students were taught mathematics by teachers who reported that their teaching was limited *very little* by students not ready for instruction; 69% were taught mathematics by teachers who reported that their teaching was limited *some*; and 6% were taught mathematics by teachers who reported that their teaching was limited *a lot*. In comparison, for the international averages, 36% of students were taught mathematics by teachers who reported that their teaching was limited *very little*; 59% reported that their teaching was limited *some*; and 6% of students were taught mathematics by teachers who reported that their teaching was limited *a lot* by students not ready for instruction.

At Year 8, 27% of Australian students were taught mathematics by teachers who reported that their teaching was limited *very little* by students not ready for instruction; 64% reported that their teaching was limited *some*; and 9% of students were taught mathematics by teachers who reported that their teaching was limited *a lot*. These figures were similar to the international averages.

As can be seen in Figure 5.6, at Year 4, Australian students taught mathematics by teachers who reported that their teaching was limited *very little* scored over 85 points higher than those taught mathematics by teachers who reported that their teaching was limited *a lot*. In comparison, Australian Year 8 students who were taught mathematics by teachers who reported that their teaching was limited *very little* scored 130 points higher than those taught mathematics by teachers who reported that their teaching was limited *a lot*. These differences are statistically significant. Internationally, on average, the gaps were over 40 points at Year 4 and over 60 points at Year 8.

Socioeconomic differences

Figure 5.7 presents the percentages of Australian Year 4 and Year 8 students in each of the categories describing whether teachers were limited by students' readiness for instruction by school socioeconomic composition. It shows at both Year 4 and Year 8, higher percentages of students were taught mathematics by teachers who reported that their teaching was limited somewhat by students not ready for instruction, irrespective of the socioeconomic composition of students' schools.

At both Year 4 and Year 8, there was a significantly higher percentage of students in *more affluent* schools than those at *more disadvantaged* schools who were taught mathematics by teachers who reported that their teaching was limited very little. There was also a significantly higher percentage of students at *more disadvantaged* schools than students at *more affluent* schools who were taught by teachers who reported that their teaching was limited a lot by students not ready for instruction.

At Year 4, there was also a significantly lower percentage of students in *more affluent* schools than those in *neither more affluent nor more disadvantaged* schools who were taught mathematics by teachers who reported that their teaching was limited a lot.

At Year 8, there was a significantly higher percentage of students in *more affluent* schools than those in *neither more affluent nor more disadvantaged* schools who were taught mathematics by teachers who reported that their teaching was limited very little. There was also a significantly lower percentage of students in *neither more affluent nor more disadvantaged* schools than those in *more disadvantaged* schools who were taught mathematics by teachers who reported that their teaching was limited a lot.

Note: Due to rounding, totals may not add to 100%.

FIGURE 5.7 The Mathematics Classroom Teaching Limited by Students Not Ready for Instruction scale, in Australia, by school socioeconomic composition

CHAPTER 6

SCIENCE TEACHER PREPARATION, PROFESSIONAL DEVELOPMENT AND JOB SATISFACTION

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- While almost all Australian Year 4 and Year 8 students were taught science by teachers with at least a *bachelor degree or equivalent*, only 16% of Year 4 students and 24% of Year 8 students were taught by teachers with a *postgraduate university degree*, compared to the international averages of 29% and 38%, respectively.
- At Year 4, 73% of students were taught science by teachers who *majored in primary education*, with a further 22% taught science by teachers who *majored in science as well as primary education*.
- At Year 8, 91% of students were taught science by teachers who *majored in either or both of science and science education*, with the remaining 9% being taught by science teachers who had *not majored in either science or science education*, and who could be considered to be teaching out-of-field.
- A higher percentage of Year 4 students from *more affluent* schools than students in *more disadvantaged* schools had science teachers who had majored in both science and primary education.
- Students' science teachers were asked about their need for future professional development opportunities in different topic areas. At both Year 4 and Year 8, the two most popular topics were *integrating technology into science instruction* and *improving students' critical thinking or inquiry skills*.
- At Year 4, 61% of students were taught by science teachers who reported that they were *very satisfied* with their careers; whereas at Year 8, this percentage was 55%. There were no significant differences in science achievement scores according to the level of job satisfaction reported by students' teachers for Australia at either year level.

6.1 Introduction

Following the structures of Chapters 4 and 5, Chapters 6 and 7 consider factors associated with effective science teaching. While Chapter 7 focuses on the teaching practices and factors in the classroom, Chapter 6 focuses on the characteristics and experiences of Australian Year 4 and Year 8 students' science teachers, and draws on data collected in the Teacher Questionnaire.

As TIMSS focuses on student outcomes, results from the Teacher Questionnaire and the School Questionnaire are presented with regard to students. This means that each result is either reported as the percentage of students who attended a school that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 6 section of the Appendices.

6.2 Science teachers' qualifications

Bachelor's and postgraduate degrees

Table 6.1 shows the percentages of Year 4 and Year 8 students according to their science teachers' higher education qualification levels. The table shows results for Australia and compares these with the international averages.

At Year 4, 80% of Australian students were taught science by teachers who had *completed a bachelor's degree or equivalent*, while an additional 16% had science teachers who had also completed a *postgraduate university degree* (i.e. doctorate, master's or other postgraduate degree). In comparison, on average across countries, 56% of Year 4 students were taught science by teachers who had completed a *bachelor's degree or equivalent*, and 29% were taught science by teachers who had completed a *postgraduate university degree*.

At Year 8, all Australian students were taught science by teachers who had at least completed a *bachelor's degree or equivalent*, and 24% of students had a science teacher who had also completed a *postgraduate university degree*. In comparison, on average across countries, 58% of Year 8 students were taught science by teachers who had completed a *bachelor's degree or equivalent*, and 38% were taught science by teachers who had completed a *postgraduate university degree*.

TABLE 6.1 Year 4 and Year 8 science teachers' formal education, Australia and the international averages

	Percentages of students by science teachers' educational level							
	Completed postgraduate university degree		Completed bachelor's degree or equivalent but not a postgraduate degree*		Completed post-secondary education but not a bachelor's degree		No further than upper-secondary education	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	16	2.0	80	2.3	3	1.2	0	0.0
International average	29	0.4	56	0.4	10	0.3	5	0.2
Year 8								
Australia	24	2.6	76	2.6	0	0.2	0	0.0
International average	38	0.4	58	0.5	2	0.2	1	0.1

Note: Due to rounding, totals may not add to 100%.

* This category includes teachers who completed a graduate diploma of education after completing an undergraduate degree.

Tertiary education majors or specialisation

In addition to reporting on teachers' levels of education, the Teacher Questionnaire also investigated the major(s) or specialisation(s) that teachers undertook during their tertiary studies and Figure 6.1 presents these data. It shows the percentages of Australian Year 4 and Year 8 students according to the type of major or specialisation of their science teachers.

At Year 4, 73% of Australian students had science teachers who had a *major in primary education but not science*. Twenty-two per cent had science teachers who had a *major in primary education and science education*. Three per cent of students had science teachers with *other majors* and 2% of students had science teachers with a *major or specialisation in science but not primary education*.

At Year 8, 65% of students had science teachers who had a *major in both science and science education*. Nineteen per cent of students had science teachers who had a *major in science but not science education* while 7% of students had science teachers who had a *major in science education but not science*. However, 9% of students had science teachers with *other majors*.

Note: Due to rounding, totals may not add to 100%.

* Insufficient data to report achievement for Australia

FIGURE 6.1 Percentages of students by the type of major of science teachers and student achievement in science, Australia and the international averages

Socioeconomic differences

Figure 6.2 shows the percentages of Australian Year 4 and Year 8 students according to the type of major or specialisation of their science teachers. It also presents these data according to three levels of socioeconomic composition of the students' schools: *more affluent*, *neither more affluent nor more disadvantaged* and *more disadvantaged*.

At Year 4, across the three levels of school socioeconomic composition, the large majority of students (more than 90%) had science teachers with at least a major in primary education. Students from *more affluent* schools had a significantly higher percentage of science teachers with a major in both primary education and science (40% in *more affluent* schools, 11% in *neither more affluent nor more disadvantaged* schools and 18% in *more disadvantaged* schools). The percentages of students across schools from all three levels of socioeconomic composition who had science teachers without a major in primary education or science were similar and ranged from 1% to 4%.

At Year 8, 59% of students at *more affluent* and *more disadvantaged* schools were taught by teachers with a major in education and science while 75% of students from schools in the *neither more affluent nor more disadvantaged* group had teachers with these qualifications. However, 14% of students from *more disadvantaged* schools had teachers who had other majors compared to 4% of students from *neither more affluent nor more disadvantaged* schools. These differences were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 6.2 Percentages of students by the type of major of science teachers, in Australia, by school socioeconomic composition

Geolocation differences

Figure 6.3 shows the percentages of Australian Year 4 and Year 8 students according to the type of major or specialisation of their science teachers, but breaks these data down according to the geographic location of students' schools. The two geographic locations are schools in *major cities* and schools in *regional and remote areas*.

At Year 4, the percentages of students being taught by teachers with each major or specialisation were similar across schools in *major cities* and schools in *regional and remote areas*.

At Year 8, the percentages of students taught by teachers with different specialisations were slightly different between schools in *major cities* compared with schools in *regional and remote areas*. In schools in *regional and remote areas*, the percentage of students who were taught by teachers with both a major in science education and science was slightly lower at 59%, compared to 66% for students from schools in *major cities*. A higher percentage (16%) of students from schools in *regional and remote areas* were taught science by teachers with other majors compared to students in schools in *major cities* (7%). These differences were, however, not statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 6.3 Percentages of students by the type of major of science teachers, in Australia, by school geographic location

6.3 Science teachers' years of experience

The Teacher Questionnaire collected information on teachers' years of experience in the teaching profession. Table 6.2 presents the percentages of students in Year 4 and Year 8 according to how many years of experience their science teacher had. The table shows the results for Australia and the international averages.

At Year 4, 31% of students were taught by science teachers who had *20 years or more* experience; 19% had science teachers with *at least 10 but less than 20 years*; 24% had science teachers with *at least 5 but less than 10 years*; and 26% of students were taught by science teachers with *less than 5 years of experience*. On average, Australian Year 4 science teachers had 13 years of experience, compared to the international average of 17 years.

At Year 8, 28% of students were taught by science teachers with *20 years or more* of experience; 22% had science teachers with *at least 10 but less than 20 years*; 21% had science teachers with *at least 5 but less than 10 years*; and 28% of students had science teachers with *less than 5 years of experience*. On average, Australian Year 8 science teachers had 13 years of experience, compared to the international average of 16 years.

TABLE 6.2 Year 4 and Year 8 science teachers' years of experience, Australia and the international averages

	Percentages of students by science teachers' years of experience								Average years of experience as a teacher	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
Australia	31	3.2	19	2.5	24	3.0	26	3.2	13	0.7
International average	40	0.5	28	0.4	17	0.4	15	0.4	17	0.1
Year 8										
Australia	28	3.1	22	2.5	21	2.6	28	3.1	13	0.7
International average	34	0.5	32	0.5	18	0.4	15	0.4	16	0.1

Note: Due to rounding, totals may not add to 100%.

Socioeconomic differences

Table 6.3 shows the percentages of students in Year 4 and Year 8 according to the experience of their science teachers and differentiates these data according to school socioeconomic composition.

At both Year 4 and Year 8, the percentages of students with teachers who reported each category of experience were similar across all socioeconomic school groupings; any apparent differences were small and not significant. The average years of experience as a teacher were also similar across groups.

TABLE 6.3 Australian Year 4 and Year 8 science teachers' years of experience, by school socioeconomic composition

	Percentages of students by science teachers' years of experience								Average years of experience as a teacher	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
More affluent	33	6.7	21	5.2	26	6.0	21	5.9	14	1.6
Neither more affluent nor more disadvantaged	30	5.6	22	4.9	22	5.7	26	4.9	12	1.1
More disadvantaged	30	6.7	19	4.9	27	6.2	24	6.8	13	1.6
Year 8										
More affluent	32	4.4	21	3.5	17	3.4	30	4.5	14	1.1
Neither more affluent nor more disadvantaged	27	4.9	18	3.8	29	5.2	26	5.4	13	1.3
More disadvantaged	26	6.1	26	5.6	21	6.0	28	4.8	12	1.4

Note: Due to rounding, totals may not add to 100%.

Geolocation differences

Table 6.4 shows the percentages of students in Year 4 and Year 8 according to the experience of their science teachers and the geographic location of their schools.

At Year 4, the percentages of students who were taught by teachers with different years of experience were similar across schools in *major cities* and schools in *regional and remote areas*. There were two exceptions. There was a higher percentage of students taught by teachers with *at least 10 but less than 20 years* of experience in schools in *regional and remote areas* compared to students from schools in *major cities* (28% compared to 16%, respectively). There was also a higher percentage of students taught by teachers with *less than 5 years* of experience (28% of students from schools in *major cities* compared to 19% of students from schools in *regional and remote areas*). While these differences were not statistically significant likely due to the large standard errors, they were notably large.

The percentages of Year 8 students taught by teachers who reported each level of experience was similar across schools in *major cities* and schools in *regional and remote areas*.

TABLE 6.4 Australian Year 4 and Year 8 science teachers' years of experience, by school geographic location

	Percentages of students by science teachers' years of experience								Average years of experience as a teacher	
	20 years or more		At least 10 but less than 20 years		At least 5 but less than 10 years		Less than 5 years			
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Years (no.)	SE
Year 4										
Major cities	30	3.8	16	3.0	26	3.8	28	4.1	12	0.8
Regional and remote	33	6.7	28	5.5	20	5.6	19	4.8	15	1.6
Year 8										
Major cities	28	3.7	23	3.2	21	3.0	29	3.5	13	0.8
Regional and remote	30	5.9	21	5.1	23	5.5	26	5.4	13	1.4

Note: Due to rounding, totals may not add to 100%.

6.4 Science teachers' participation in professional development

Many education systems, including Australia's, require registered teachers to participate in ongoing professional development (PD) – supplementary to their initial qualifications – to ensure that students benefit from up-to-date instruction methods and information.

Figure 6.4 presents the percentages of Year 4 and Year 8 students whose teachers reported participating in various forms of PD in the past two years. Teachers' attendance at PD is influenced by multiple factors such as the availability of particular courses to teachers and schools, school funding, school or systemic requirements as well as opportunity or time and teacher interest.

At Year 4, the most attended topic was *improving students' critical thinking or inquiry skills*, 43% of students were taught science by teachers who attended PD on this topic in the past two years. The next most attended topics were *science content* and *science curriculum* (both 35%), *integrating technology into science instruction* (34%), *science pedagogy/instruction* (31%), *addressing individual students' needs* and *integrating science with other subjects* (both 30%). The topic with the lowest uptake was *science assessment*, with 18% of students taught by teachers who had attended PD on this topic in the past two years. Internationally, the percentages of students whose science teachers attended PD on the topics listed were similar to Australia's. However, there was a 10 percentage point difference between the international average and Australia for *science assessment* (28% and 18%, respectively).

At Year 8 in Australia, there was an emphasis on *addressing individual students' needs* and 66% of students had science teachers who reported attending PD on this topic in the past two years. There was also a focus on *science curriculum* where 62% of students had teachers who had attended PD on this topic. The next most attended topics were *improving students' critical thinking or inquiry skills* (55%), *science pedagogy/instruction* (54%), *science content* (50%) and *integrating technology into science instruction* (49%). Similar to the findings for Year 4, the topic with the lowest uptake was *science assessment*, where 44% of students were taught science by teachers who attended PD on this topic in the past two years. Internationally, the percentages of students who had science teachers who attended PD on any particular topic were largely similar to Australia's. There were three exceptions: a greater number of Australian students had teachers who attended PD on *science curriculum* and *improving students' critical thinking or inquiry skills*. And notably, there was a 22 percentage point difference between Australia and the international average in *addressing individual students' needs* (66% and 44% respectively).

Note: Due to rounding, totals may not add to 100%.

FIGURE 6.4 Percentages of students by science teachers' areas of professional development, Australia and the international averages

Science teachers' professional development needs

To complement data on participation in professional development, the Teacher Questionnaire also asked teachers about their need for future PD opportunities in different topic areas.

Figure 6.5 presents the percentages of Year 4 and Year 8 students whose science teachers reported needing various forms of PD in the future. These data were less likely to be influenced by the various factors that may have impacted on teachers' previous attendance at PD (e.g. funding and availability etc.) and were more likely to reflect teachers' interest in furthering their knowledge and understanding on particular topic areas.

Note: Due to rounding, totals may not add to 100%.

FIGURE 6.5 Percentages of students by science teachers' needs for future professional development, Australia and the international averages

At Year 4, the percentages of students taught by teachers who reported needing future PD were high, ranging from 54% to 74% across topic areas. The most requested topic was *integrating technology into science instruction*, where 74% of students were taught by teachers who expressed a need for PD in this area. The next most requested topics were *improving students' critical thinking or inquiry skills* (68%), *integrating science with other subjects* (67%) and *science assessment* (66%). These were followed by *addressing individual students' needs* (61%), *science pedagogy/instruction* (59%), and *science content* and *science curriculum* (both 54%). Internationally, there was not a great deal of variation between the percentages of students whose science teachers reported a need for PD in the topics listed compared within Australia. However, the international average for the percentage of students with teachers who expressed a need for PD on *science assessment* was 12 percentage points lower than that for Australia.

The percentages of students who were taught by teachers who reported needing PD were higher across all topics when compared to the percentage that participated in PD on each topic over the past two years. This was the most notable for *science assessment* (a 48% difference) and *integrating technology into science instruction* (a 40% difference). The format of the Teacher Questionnaire allowed teachers to respond freely to both questions that asked about the PD teachers had attended as well future PD needs. A teacher could have responded that they attended PD on a particular topic in the past two years and then also indicated they wanted future further training on this topic.

At Year 8, there was also a large percentage of students who were taught by teachers who reported needing PD across all topic areas, ranging from 51% to 81%. The most requested topics were *improving students' critical thinking or inquiry skills* and *integrating technology into science instruction* (81% and 77%, respectively). The next most popular topics were *addressing individual students' needs* (71%), *science pedagogy/instruction* (65%), *science assessment* (59%), *science content* (52%) and *science curriculum* (51%). Internationally, there were similar percentages of students who were taught by teachers who reported needing PD across topics. One exception was *improving students' critical thinking or inquiry skills* where the percentage of Australian students whose teachers requested this topic was 13% higher than the international average.

For some topics, there was a notably higher percentage of students who were taught by teachers who reported needing PD on that topic compared to the percentage of students being taught by teachers who participated in that topic over the past two years. The greatest difference was for the topics of *integrating technology into science instruction* (a 28% difference) and *improving students' critical thinking or inquiry skills* (a 26% difference).

6.5 Science teachers' job satisfaction

Teachers' satisfaction with their careers can impact their wellbeing and students' attitudes towards learning, the classroom and their achievement. Job satisfaction can also be associated with teacher efficacy and therefore is an area of interest when investigating teacher effectiveness.

Teachers were asked to indicate how often ('very often', 'often', 'sometimes' or 'never or almost never') they agreed with the following statements:

- ▶ I am content with my profession as a teacher.
- ▶ I find my work full of meaning and purpose.
- ▶ I am enthusiastic about my job.
- ▶ My work inspires me.
- ▶ I am proud of the work I do.

Their responses to these five items were combined to create the Teacher Job Satisfaction scale. Students were then assigned to three groups based on their teachers' scale scores.

At Year 4, students with *very satisfied* science teachers had a scale score of at least 10.1, which corresponded to teachers responding 'very often' to three of the five statements and responding 'often' to the other two, on average. Students with *less than satisfied* teachers had a scale score no higher than 6.5, which corresponded to teachers responding 'sometimes' to three of the five statements and 'often' to the other two, on average. All other students had *somewhat satisfied* teachers.

At Year 8, students with *very satisfied* science teachers had a scale score of at least 10.2, which corresponded to teachers responding 'very often' to three of the five statements and responding 'often' to the other two, on average. Students with *less than satisfied* science teachers had a scale score no higher than 6.8, which corresponded to teachers reporting 'sometimes' to three of the five statements and 'often' to the other two, on average. All other students had *somewhat satisfied* teachers.

FIGURE 6.6 The Science Teacher Job Satisfaction scale and student achievement in science, Australia and the international averages

Figure 6.6 presents the proportions of students in Year 4 and Year 8 for each of the job satisfaction categories, along with their average science achievement scores.

At Year 4, 61% of Australian students had science teachers who reported that they were *very satisfied* with their careers; 34% of students had science teachers who reported that they were *somewhat satisfied*; and 6% of students had science teachers who reported that they were *less than satisfied*. Australia's results closely aligned with the average international results.

At Year 8, 55% of Australian students had science teachers who reported that they were *very satisfied* with their careers; 34% of students had science teachers who reported that they were *somewhat satisfied*; and 11% had science teachers who reported that they were *less than satisfied*. These percentages were very similar to the international results.

There was no clear relationship between the Teacher Job Satisfaction scale and science achievement with no significant differences found between achievement scores according to the level of job satisfaction reported by Australian students' teachers for either year level.

Socioeconomic differences

Figure 6.7 presents the proportions of Australian Year 4 and Year 8 students in each of the job satisfaction categories by school socioeconomic composition.

FIGURE 6.7 The Science Teacher Job Satisfaction scale, in Australia, by school socioeconomic composition

At Year 4, across each level of satisfaction and for each school socioeconomic composition, the percentages of students with teachers who reported that they were less than, somewhat or very satisfied with their teaching careers, were generally similar. Where there were differences in magnitude, these were not statistically significant, likely due to large standard errors. However it is interesting to note that, while 61% of students from *more affluent* schools and 59% of students from *neither more affluent nor more disadvantaged* schools had teachers who reported that they were very satisfied with their careers, 53% of students from *more disadvantaged* schools had teachers who reported this level of job satisfaction. Also, there was a greater percentage of students from *more disadvantaged* schools (42%) with teachers who were somewhat satisfied with their careers compared with students from *more affluent* schools (35%) and *neither more affluent nor more disadvantaged* schools (33%).

Results for Year 8 followed the same pattern. In general, across each level and for each category of school socioeconomic composition, the percentages of students with teachers who reported that they were less than, somewhat or very satisfied as teachers, were mostly similar, but with one exception. Fifty-nine per cent of students from *more affluent* schools reported that they were very satisfied with their careers, 53% of students from *neither more affluent nor more disadvantaged* schools and 51% of students from *more disadvantaged* schools had teachers who reported this level of job satisfaction. However these differences were not statistically different, likely due to the large standard errors.

Geolocation differences

Figure 6.8 presents the proportions of Australian students in each of the job satisfaction categories according to the geographic location of their schools.

At Year 4, results for the Teacher Job Satisfaction scale were mostly similar for the teachers of students from schools in *major cities* compared to the teachers of students from schools in *regional and remote areas*. While differences were not statistically different due to large standard errors, there were some of note. That is, whereas 64% of students from schools in *major cities* had teachers who reported being very satisfied with their job, only 51% of students from schools in *regional and remote areas* had teachers with this same level of job satisfaction. There was also a greater percentage of students from *regional and remote schools* (41%) with teachers who were somewhat satisfied with their job compared to the percentage of students from schools in *major cities* (31%).

At Year 8, a similar pattern of results could be observed. The percentage of students from schools in *major cities* with teachers who were very satisfied with their job was higher when compared to the percentage of students from schools in *regional and remote areas* (58% and 46% respectively) although this difference was not significant. There was, however, a significantly higher percentage of students from schools in *regional and remote areas* (48%) with teachers who were somewhat satisfied with their job compared to the percentage of students from schools in *major cities* (30%).

FIGURE 6.8 The Science Teacher Job Satisfaction scale, in Australia, by school geographic location

CHAPTER 7

TEACHING SCIENCE

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- 68% of Year 4 students and 41% of Year 8 students reported *high clarity of instruction* in their science lessons. These students had higher achievement in science than students who reported *low clarity of instruction*.
- At Year 4, 78% of students had computers *available for use* in science lessons, while in Year 8 the proportion was slightly larger at 87%. At Year 8, access to computers during science lessons was associated with significantly higher achievement in science than not having access.
- 35% of Year 4 students and 14% of Year 8 students had science teachers who emphasised scientific investigation in *about half the lessons or more*. There was no relationship between the degree to which science teachers emphasised scientific investigation and the average science achievement for both year levels.
- Only 21% of Australian Year 4 students attended schools with science laboratories available for their use compared to the international average of 36%. At Year 8, 100% of Australian students attended schools with science laboratories available for their use compared to the international average of 85%. In Australia, there were no differences for Year 4 and Year 8 students in average science achievement according to the resources available for conducting science experiments.
- 13% of Year 4 students and 5% of Year 8 students *never* conducted experiments in their science lessons. Students who *never* conducted experiments in their science lessons had lower science achievement than those who conducted experiments at least *a few times a year*.
- A lower percentage of Year 8 students from *more affluent* schools never conducted experiments in their science lessons compared to students in *more disadvantaged* schools.
- Around 25% of Year 4 and Year 8 students were taught science by teachers who reported that their teaching was limited *very little* by students not ready for instruction, and around 70% of students were taught by science teachers who reported that their teaching was limited *some*. Students whose science teachers reported that their teaching was limited *very little* had higher achievement than students whose science teachers reported that their teaching was limited *a lot*.
- A higher percentage of Year 4 and Year 8 students who attended *more disadvantaged* schools than those who attended *more affluent* schools had science teachers who reported that their teaching was limited a lot by students not ready for instruction.

7.1 Introduction

Chapter 6 presented data on Australian students' Year 4 and Year 8 science teachers in terms of their characteristics and experiences. Chapter 7 focuses on the teaching practices and factors in the classroom that can support or obstruct effective science teaching as collected in the TIMSS 2019 Student Questionnaire and the Teacher Questionnaire. Together, Chapters 6 and 7 present information on factors relating to science teacher effectiveness for Australian Year 4 and Year 8 students.

As TIMSS focuses on student outcomes, results from the Teacher Questionnaire and the School Questionnaire are presented with regard to students. This means that each result is either reported as the percentage of students who attended a school that had certain characteristics or as the percentage of students who were taught by teachers who responded in a particular way. Please see the Reader's Guide for more information.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 7 section of the Appendices.

7.2 Instructional time in science

Instructional time in science classes is likely to impact on students' science learning. Using TIMSS data derived from teachers' reports of weekly instructional time for science and principals' reports of how many days the school is open for instruction (weekly and yearly), it was possible to estimate of the average hours per year that Australian students received in science instruction.

In Australia, the average time spent on Year 4 science instruction was 53 hours per year. The international average was 75 hours per year. There was considerable variation in the hours of instruction time for other countries that participated in TIMSS 2019. The Philippines reported 158 hours per year and was the country with the highest instruction time. Singapore had 84 hours, the United States 83 hours, Canada 80 hours, New Zealand 40 hours, and Northern Ireland had 38 hours. The Republic of Ireland had the lowest amount of instruction time with an average of 34 hours per year.

At Year 8, in Australia, the average time spent on science instruction was 124 hours per year. The international average was 137 hours per year. Lebanon spent the most time on science instruction with an average of 243 hours per year. The United States had 140 hours per year, New Zealand 124 hours, Singapore 112 hours, Hong Kong 104 hours and Ireland had 87 hours. Italy spent the least time on science instruction with an average of 70 hours per year.

7.3 Coverage of TIMSS science topics

Teachers were asked whether the students in the participating TIMSS class had been taught each of the TIMSS topics mostly before or during the year of assessment. Table 7.1 shows the TIMSS topics for science at both Year 4 and Year 8 according to the content domains. Figure 7.1 shows the percentages of Year 4 and Year 8 students who had been taught the TIMSS topics, on average, for each content domain. The figure shows the results for Australia and the international averages.

Sixty-five per cent of Australian Year 4 students had been taught all of the TIMSS science topics before or during Year 4. Across the domains, this proportion ranged from 63% for *physical science* to 70% for *life science*. Internationally, the percentage of Year 4 students who had been taught the TIMSS topics was similar to Australia's in each domain.

At Year 8, 63% of Australian students had been taught all of the TIMSS science topics before or during Year 8. Across the domains, this proportion ranged from 56% for *physics* to 79% for *Earth science*. Internationally, the percentage of Year 8 students who had been taught the TIMSS topics was higher than for Australia in each domain except *Earth science*.

TABLE 7.1 The TIMSS science topics at Year 4 and Year 8

Year 4	
Content domains	Topic areas
<i>Life science</i>	<ul style="list-style-type: none"> ▶ Physical and behavioural characteristics of living things and the major groups of living things (e.g. mammals, birds, insects, flowering plants) ▶ Major body structures and their functions in humans, other animals and plants ▶ Life cycles of common plants and animals (e.g. flowering plants, butterflies, frogs) ▶ Characteristics of plants and animals that are inherited ▶ Interactions between organisms and their environments (e.g. physical features and behaviours that help living things survive in their environments) ▶ Relationships in ecosystems (e.g. simple food chains, predator-prey relationships, competition) ▶ Human health (transmission and prevention of diseases, everyday behaviours that promote good health)
<i>Physical science</i>	<ul style="list-style-type: none"> ▶ States of matter (solid, liquid, gas) and properties of the states of matter (volume, shape) ▶ Classifying materials based on physical properties (e.g. weight/mass, volume, state of matter, conductivity of heat or electricity) ▶ Mixtures, including methods for separating a mixture into its components (e.g. sifting, filtering, evaporation, using a magnet) ▶ Properties of magnets (e.g. like poles repel and opposite poles attract, magnets can attract some objects) ▶ Physical changes in everyday life (e.g. changes of state, dissolving) ▶ Chemical changes in everyday life (e.g. decaying, burning, rusting, cooking) ▶ Common sources of energy (e.g. the Sun, wind, oil) and uses of energy (heating and cooling homes, providing light) ▶ Light and sound in everyday life (e.g. shadows and reflections, vibrating objects make sound) ▶ Heat transfer (e.g. energy flows from a hot object to a colder object) ▶ Electricity and simple electrical circuits (e.g. a circuit must be complete to work correctly) ▶ Forces that cause objects to move (e.g. gravity, pushing/pulling) or change their motion (e.g. friction) ▶ Simple machines (e.g. levers, pulleys, wheels, ramps) that help make motion easier
<i>Earth science</i>	<ul style="list-style-type: none"> ▶ Physical makeup of Earth's surface (e.g. land and water in unequal proportions, sources of fresh and salt water) ▶ Earth's resources used in everyday life (e.g. water, wind, soil, forests, oil, natural gas, minerals) ▶ Changes in Earth's surface over time (e.g. mountain building, weathering, erosion) ▶ Fossils and what they can tell us about past conditions on Earth ▶ Weather and climate (e.g. daily, seasonal and locational variations versus long term trends) ▶ Objects in the Solar System (the Sun, the Earth, the Moon and other planets) and their movements ▶ Earth's motion and related patterns observed on Earth (e.g. day and night, seasons)

Year 8	
Content domains	Topic areas
<i>Biology</i>	<ul style="list-style-type: none"> ▶ Differences among major taxonomic groups of organisms (plants, animals, fungi, mammals, birds, reptiles, fish, amphibians, insects) ▶ Major organs and organ systems in humans and other organisms (structure/function, life processes) ▶ Cells, their structure and functions, including respiration and photosynthesis as cellular processes ▶ Life cycles, sexual reproduction and heredity (inherited versus acquired/learned characteristics) ▶ Role of variation and adaptation in survival/extinction of species (including fossil evidence) ▶ Interdependence of populations of organisms in an ecosystem (e.g. carbon and water cycles, energy flow, food webs, competition, predation, human impacts on ecosystems) ▶ Human health (e.g. causes, transmission and prevention of common infectious diseases, immunity) and the importance of diet, exercise and other lifestyle choices in maintaining health
<i>Chemistry</i>	<ul style="list-style-type: none"> ▶ Particulate structure, classification and composition of matter (protons, neutrons, electrons, atoms, molecules, elements, compounds, mixtures) ▶ The periodic table as an organising principle for the known elements ▶ Physical and chemical properties of matter ▶ Mixtures and solutions (e.g. solvent, solute, concentration/dilution) ▶ Properties of common acids and bases (e.g. acids have pH less than 7, reactions with indicators produce colour changes, acids and bases neutralise each other) ▶ Characteristics of chemical reactions (e.g. transformation of reactants, evidence of chemical change) ▶ Matter and energy in chemical reactions (conservation of matter, familiar exothermic and endothermic reactions, factors affecting reaction rates) ▶ The role of electrons in chemical bonds
<i>Physics</i>	<ul style="list-style-type: none"> ▶ Physical states and changes in matter (explanations of properties in terms of movement and distance between particles; phase change, changes in volume and/or pressure, physical changes) ▶ Energy transformation and transfer (e.g. forms of energy, energy conservation, heat temperature, equilibrium) ▶ Basic properties/behaviours of light (reflection, refraction, colour, shadows, simple ray diagrams) ▶ Basic properties/behaviours of sound (vibrations that produce sound, transmission through media, loudness, pitch) ▶ Electric circuits (e.g. electrical conductors/insulators and the flow of electricity in series/parallel circuits) ▶ Properties and uses of permanent magnets and electromagnets ▶ Motion and forces (e.g. basic description of motion, common mechanical forces, properties of forces, effects of forces, simple machines, buoyancy, effects of density and pressure)
<i>Earth science</i>	<ul style="list-style-type: none"> ▶ Earth's structure and physical features (e.g. Earth's crust, mantle and core; composition and relative distribution of water; composition of Earth's atmosphere) ▶ Earth's processes, cycles and history (e.g. rock cycle, major geological events, formation of fossils and fossil fuels, water cycle, weather versus climate) ▶ Earth's resources, their use and conservation (e.g. renewable/nonrenewable resources, human use of land and water resources) ▶ Earth in the Solar System and the universe (phenomena on Earth: seasons, eclipses, tides, phases of moon; members of the Solar System; physical features of Earth)

Note: Due to rounding, totals may not add to 100%.

FIGURE 7.1 Percentages of students taught the TIMSS science topics, Australia and the international averages

7.4 Instructional clarity in science lessons

The degree to which teachers are clear in the way they deliver the science curriculum can have an impact on student learning. Students were asked to indicate their level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements about instructional clarity in their science lessons:

- ▶ I know what my teacher expects me to do.
- ▶ My teacher is easy to understand.
- ▶ My teacher has clear answers to my questions.
- ▶ My teacher is good at explaining science.
- ▶ My teacher does a variety of things to help us learn.
- ▶ My teacher links new lessons to what I already know. (Year 8 only)
- ▶ My teacher explains a topic again when we don't understand.

Students' responses to these seven items were combined to create the Instructional Clarity in Science Lessons scale. Students were then assigned to groups based on their scale scores.

At Year 4, students who reported *high clarity of instruction* had a scale score of at least 8.8, which corresponded to 'agreeing a lot' to three of the six statements and 'agreeing a little' to the other three, on average. Students who reported *low clarity of instruction* had a scale score no higher than 6.9, which corresponded to 'disagreeing a little' to three of the six statements and 'agreeing a little' to the other three, on average. All other students reported *moderate clarity of instruction* in their science lessons.

At Year 8, students who reported *high clarity of instruction* had a score on the scale of at least 10.3, which corresponded to 'agreeing a lot' to four of the seven statements and 'agreeing a little' to the other three, on average. Students who reported *low clarity of instruction* had a scale score no higher than 7.8, which corresponded to 'disagreeing a little' to four of the seven statements and 'agreeing a little' to the other three, on average. All other students reported *moderate clarity of instruction* in their science lessons.

FIGURE 7.2 The Instructional Clarity in Science scale and student achievement in science, Australia and the international averages

Figure 7.2 presents the percentages of Australian Year 4 and Year 8 students in the clarity of instruction categories, along with their average achievement in science. It shows that 68% of Year 4 students in Australia reported *high clarity of instruction* in their science lessons, in contrast to 24% of students who reported *moderate clarity of instruction*, and 8% of students who reported *low clarity of instruction* in their science lessons. In comparison, for the international averages, 72% of Year 4 students reported *high clarity of instruction* in their science lessons, 22% reported *moderate clarity of instruction*, and 6% of students reported *low clarity of instruction*.

At Year 8, 41% of students in Australia reported *high clarity of instruction* in their science lessons, 40% of students reported *moderate clarity of instruction*, and 18% of students reported *low clarity of instruction*. In comparison, for the international averages, 49% of Year 8 students reported *high clarity of instruction* in their science lessons, 38% reported *moderate clarity of instruction*, and 13% of students reported *low clarity of instruction*.

Figure 7.2 shows that at Year 4, students who reported *high* or *moderate clarity of instruction* in their science lessons scored significantly higher than those who reported *low clarity of instruction* (by 14 and 19 points, respectively). At Year 8, students who reported *high clarity of instruction* scored 25 points higher than those who reported *moderate clarity of instruction* and 41 points higher than those who reported *low clarity of instruction*. Students who reported a *moderate clarity of instruction* in their science lessons scored 16 points higher than those who reported *low clarity of instruction*. These differences were statistically significant. Internationally, on average, the gap between *high clarity of instruction* and *low clarity of instruction* was just over 30 points at Year 4 and just over 40 points at Year 8.

Socioeconomic differences

Figure 7.3 presents the percentages of Australian Year 4 and Year 8 students in each of the instructional clarity categories, by school socioeconomic composition. It shows that at Year 4 and Year 8, the percentages of students in each of the categories were relatively similar across all three levels of school socioeconomic composition. The only statistically significant differences were at Year 4 for *neither more affluent nor more disadvantaged* schools where the percentage of students who experienced high clarity of instruction was significantly lower than for *more affluent* schools and the percentage of students who experienced moderate clarity of instruction was significantly higher than for *more affluent* schools and also *more disadvantaged* schools.

FIGURE 7.3 The Instructional Clarity in Science scale, in Australia, by school socioeconomic composition

7.5 Technology in science instruction

Technology has become a regular component of science classrooms in primary and secondary schools for many countries. In the Teacher Questionnaire, teachers were asked about their use of computers while teaching science and the frequency with which they used technology to support student learning.

Computer access for instruction

Teachers were asked about their use of computers while teaching science to the TIMSS students. Table 7.2 presents the percentages of students (for Australia and internationally) who had access to computers during science classes and the type of access (individual or shared), as reported by teachers.

TABLE 7.2 Computer access during science lessons and student achievement in science, Australia and the international averages

	Computers available for students to use in science lessons						Percentages of students by computer access*					
	Students (%)		Science achievement									
	Yes		Yes		No		Each student has a computer		The class has computers that students can share		The school has computers that the class can sometimes use	
	Students (%)	SE	Mean	SE	Mean	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4												
Australia	78	2.8	535	3.1	529	6.5	33	3.4	41	3.7	49	4.3
International average	45	0.4	496	1.0	490	0.8	14	0.3	22	0.4	36	0.5
Year 8												
Australia	87	1.6	537	3.8	505	10.6	67	2.8	18	2.4	51	2.7
International average	48	0.5	496	1.1	486	1.4	19	0.4	17	0.4	39	0.5

Note: Due to rounding, totals may not add to 100%.

* Teachers could indicate the class having more than one type of computer access.

At Year 4, 78% of Australian students had computers available for use in science lessons, while in Year 8 the proportion was slightly larger at 87%. These percentages were higher than the international averages by over 30 percentage points for both year levels.

In Year 4, there were only small differences in the average science achievement between students who had access to computers during science lessons and those who did not. However, in Year 8 access to computers during science lessons was associated with statistically significantly higher achievement in science. Internationally, on average across countries, in both Year 4 and Year 8, there were significant differences in the average science achievement between students who had access to computers during science lessons and those who did not. Those with access scored statistically significantly higher.

Technology to support learning

The Teacher Questionnaire also collected data on how frequently teachers reported using computers to support learning during science lessons.

At Year 4, only 7% of Australian students on average were in classes in which their teachers reported using technology to support learning *every day or almost every day*, 28% of students had teachers who reported *once or twice a week*, 30% of students had teachers who reported *once or twice a month* and 35% of students had teachers who reported *never or almost never*. These were higher than the corresponding international averages, with the exception that a higher proportion of students (60%) had teachers who reported they *never or almost never* used technology to support learning in science lessons.

There was a wide range across countries in the percentages of Year 4 students with teachers who reported they used technology to support learning in science lessons at least once a month. Most students in Georgia (96%) had teachers who reported using technology at least once a month, compared to only 5% in South Africa. In the Republic of Ireland, the percentage was 31%; in England it was 32%; Singapore 50%; Canada 55%; Northern Ireland 60%; Australia 65%; the United States 67%; and in New Zealand it was 73%.

At Year 8, 30% of Australian students on average were in classes in which their teachers reported using technology to support learning *every day or almost every day*, 40% of students had teachers who reported *once or twice a week*, 17% of students had teachers who reported *once or twice a month* and 14% of students had teachers who reported *never or almost never*. These were higher than the corresponding international percentages, with an exception that a higher proportion of students (56%) had teachers who reported they *never or almost never* used technology to support learning in science lessons.

There was also a wide range across countries in the percentages of Year 8 students with teachers who reported using technology to support learning in science lessons at least once a month. Most students in New Zealand and Sweden (87%), closely followed by Australia (86%) had teachers who reported they used technology at least once a month compared to only 6% in South Africa. In England, the percentage was 25%; in the Republic of Ireland it was 35%; Singapore 42%; and in the United States it was 80%.

7.6 Emphasis on scientific investigation

Teachers were asked about the frequency ('every or almost every lesson', 'about half the lessons', 'some lessons' or 'never') with which they asked their students to do the following scientific investigation activities:

- ▶ observe natural phenomena and describe what they see
- ▶ watch you demonstrate an experiment or investigation
- ▶ design or plan experiments or investigations
- ▶ conduct experiments or investigations
- ▶ present data from experiments or investigations
- ▶ interpret data from experiments or investigations
- ▶ use evidence from experiments or investigations to support conclusions
- ▶ do field work outside of class.

Teachers' responses to these eight items were combined to create the Emphasis on Scientific Investigation scale. Students were then assigned to groups based on their science teachers' scale scores.

At both Year 4 and Year 8, students with teachers who emphasised scientific investigation *in about half the lessons or more* had a scale score of at least 11.3, which corresponded to teachers using all eight activities in 'about half the lessons', on average. All other students had teachers who emphasised scientific investigation in *less than half the lessons*.

Figure 7.4 presents the percentages of Australian Year 4 and Year 8 students in each of the scientific investigation categories, along with their average achievement in science.

Note: Due to rounding, totals may not add to 100%.

FIGURE 7.4 The Emphasis on Scientific Investigation scale and student achievement in science, Australia and the international averages

At Year 4, 35% of students were taught science by teachers who emphasised scientific investigation in *about half the lessons or more*, while 65% were taught by teachers who emphasised it in *less than half the lessons*. In comparison, for the international averages, 31% of students were taught science by teachers who emphasised scientific investigation in *about half the lessons or more*, while 69% had teachers who emphasised it in *less than half the lessons*.

At Year 8, 14% of students were taught science by teachers who emphasised scientific investigation in *about half the lessons or more*, while 86% had teachers who emphasised it in *less than half the lessons*. In comparison, for the international averages, 27% of students were taught by teachers who emphasised scientific investigation in *about half the lessons or more*, while 73% had teachers who emphasised it in *less than half the lessons*.

There was no relationship between the degree to which science teachers emphasised scientific investigation and the average science achievement for both year levels.

Socioeconomic differences

Figure 7.5 presents the percentages of Australian Year 4 and Year 8 students in each of the frequency of emphasis on investigation categories by school socioeconomic composition. It shows that at both year levels, the percentages of students in each of the categories were similar across all three levels of school socioeconomic composition. None of these differences were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 7.5 The Emphasis on Scientific Investigation scale, in Australia, by school socioeconomic composition

7.7 School resources for science experiments

School principals were asked whether their schools had science laboratories available for use by Year 4 or Year 8 students, and whether teachers had assistance (such as a laboratory technician) when students conducted experiments.

Table 7.3 presents the percentages of Year 4 and Year 8 students, along with average achievement in science, according to the availability of science resources in schools.

Only 21% of Year 4 students attended schools with science laboratories available for their use compared to the international average of 36% of students. Similarly, only 15% of Year 4 students (compared to 35% of students internationally) attended schools that provided assistance to teachers when students conducted experiments.

At Year 8, 100% of students attended schools with science laboratories available for use compared to the international average of 85% of students. However, only 66% of Year 8 students compared to the international average of 54% of students attended schools that provided assistance to teachers when students conducted experiments.

In Australia, there were no differences for Year 4 and Year 8 students in average science achievement according to resources available for conducting science experiments.

TABLE 7.3 School resources for conducting science experiments and student achievement in science, Australia and the international averages

	Schools have a science laboratory								Teachers have assistance when students are conducting experiments							
	Yes				No				Yes				No			
	Students (%)		Science achievement		Students (%)		Science achievement		Students (%)		Science achievement		Students (%)		Science achievement	
	Students (%)	SE	Mean	SE	Students (%)	SE	Mean	SE	Students (%)	SE	Mean	SE	Students (%)	SE	Mean	SE
Year 4																
Australia	21	2.9	537	6.3	79	2.9	531	3.5	15	2.7	537	6.6	85	2.7	531	3.2
International average	36	0.4	496	1.3	64	0.4	486	0.9	35	0.4	491	1.1	65	0.4	491	0.7
Year 8																
Australia	100	0.0	530	3.3	0	0.0	~	~	66	3.4	532	3.5	34	3.4	526	7.6
International average	85	0.4	494	0.7	15	0.4	457	2.2	54	0.5	494	1.2	46	0.5	483	1.4

Note: Due to rounding, totals may not add to 100%.

7.8 Experiments in science lessons

Figure 7.6 presents the percentages of Year 4 and Year 8 students, along with the average achievement in science, according to the frequency with which they conducted experiments in science lessons.

At Year 4, 26% of Australian students reported conducting experiments *at least once a week*, 30% *once or twice a month*, 31% *a few times a year* and 13% *never* conducted experiments in their science lessons.

At Year 8, 39% of Australian students reported conducting experiments *at least once a week*, 42% *once or twice a month*, 14% *a few times a year* and only 5% *never* conducted experiments in their science lessons.

Figure 7.6 shows a complex association between the reported frequency of experiments in science lessons and achievement, at both Year 4 and Year 8. There is some indication that conducting experiments sometimes is associated with higher achievement than never conducting experiments, especially at Year 8, where students who reported *never* had average achievement that was at least 70 points lower than any other group.

Note: Due to rounding, totals may not add to 100%.

FIGURE 7.6 Frequency with which students conducted experiments in science lessons and student achievement in science, Australia and the international averages

Socioeconomic differences

Figure 7.7 presents the percentages of Year 4 and Year 8 students, according to the frequency with which they conducted experiments, by school socioeconomic composition. It shows that the percentages of Australian students who conducted science experiments were similar across all three levels of school socioeconomic composition. The only significant differences were for Year 8 Australian students who *never* conducted science experiments with only 1% of students in *more affluent* schools compared to 6% in *neither more affluent nor more disadvantaged* schools and 9% in *more disadvantaged* schools.

FIGURE 7.7 Frequency with which students conducted experiments in science lessons, in Australia, by school socioeconomic composition

7.9 Science teaching limited by students not ready for instruction

Teachers of the Year 4 and Year 8 classes that undertook TIMSS 2019 were asked their opinion on the extent to which instruction at their school was limited ('a lot', 'some' or 'not at all') by the following student attributes:

- ▶ students lacking prerequisite knowledge or skills
- ▶ students suffering from lack of basic nutrition
- ▶ students suffering from not enough sleep
- ▶ students absent from class
- ▶ disruptive students
- ▶ uninterested students
- ▶ students with mental, emotional or psychological impairment
- ▶ students with difficulties understanding the language of instruction.

Teachers' responses to these eight items were combined to create the Classroom Teaching Limited by Students Not Ready for Instruction scale. Students were then assigned to groups based on their science teachers' scale scores.

At Year 4, students with science teachers who felt their teaching was limited *very little* had a scale score of at least 10.8, which corresponded to their teachers feeling they were 'not at all' limited by four of the eight attributes and to 'some' extent limited by the other four, on average. Students with teachers who felt their teaching was limited *a lot* had a scale score no higher than 6.8, which corresponded to their

teachers reporting feeling limited 'a lot' by four of the eight attributes and to 'some' extent limited by the other four, on average. All other students had teachers who felt their teaching was limited somewhat (*some*).

At Year 8, students with science teachers who felt their teaching was limited *very little* had a scale score of at least 11.2, which corresponded to their teachers feeling 'not at all' limited by four of the eight attributes and to 'some' extent limited by the other four, on average. Students with teachers who felt their teaching was limited *a lot* had a scale score no higher than 7.2, which corresponded to their teachers reporting feeling limited 'a lot' by four of the eight attributes and to 'some' extent limited by the other four, on average. All other students had teachers who felt their teaching was limited somewhat (*some*).

Figure 7.8 presents the percentages of Australian Year 4 and Year 8 students in each of these categories, along with their average achievement in science.

Note: Due to rounding, totals may not add to 100%.

FIGURE 7.8 The Science Classroom Teaching Limited by Students Not Ready for Instruction scale and student achievement in science, Australia and the international averages

At Year 4, 26% of Australian students were taught science by teachers who reported that their teaching was limited *very little* by students not ready for instruction; 69% were taught science by teachers who reported that their teaching was limited *some*; and 6% were taught science by teachers who reported that their teaching was limited *a lot*. In comparison, the international averages were that 37% of students were taught science by teachers who reported that their teaching was limited *very little*; 58% were taught science by teachers who reported that their teaching was limited *some*; and 6% were taught by teachers who reported that their teaching was limited *a lot* by students not ready for instruction.

At Year 8, 23% of Australian students were taught science by teachers who reported that their teaching was limited *very little* by students not ready for instruction; 72% were taught science by teachers who reported that their teaching was limited *some*; and 5% were taught science by teachers who reported that their teaching was limited *a lot*. In comparison, the international averages were 26% of students were taught science by teachers who reported that their teaching was limited *very little*; 66% were taught by teachers who reported that their teaching was limited *some*; and 8% were taught science by teachers who reported that their teaching was limited *a lot* by students not ready for instruction.

As can be seen in Figure 7.8, at Year 4, Australian students who were taught science by teachers who reported that their teaching was limited *very little* scored 78 points higher than those who reported that their teaching was limited *a lot*. In comparison, Australian Year 8 students who were taught science by teachers who reported that their teaching was limited *very little* scored almost 100 points higher than those who reported their teaching was limited *a lot*. These differences were statistically significant. Internationally, on average, the gap was over 40 points at Year 4 and almost 60 points at Year 8.

Socioeconomic differences

Figure 7.9 presents the percentages of Australian Year 4 and Year 8 students in each of the categories that described whether teachers were limited by students' readiness for instruction by school socioeconomic composition. It shows that at both Year 4 and Year 8, higher percentages of students were taught science by teachers who reported that their teaching was limited somewhat by students not ready for instruction irrespective of school socioeconomic composition. However, the percentage of Year 4 students who had teachers who reported that their teaching was limited *a lot* was significantly lower in *more affluent* schools than in *neither more affluent nor more disadvantaged* schools and *more disadvantaged* schools.

At Year 8, the percentages of students in each of the Teaching Students Not Ready for Instruction scale categories were significantly different when comparing *more affluent* schools and *more disadvantaged* schools. There were also significant differences between *more affluent* schools and *neither more affluent nor more disadvantaged* schools in the percentages of students whose teachers reported that their teaching was limited very little or somewhat by students not ready for instruction.

FIGURE 7.9 The Science Classroom Teaching Limited by Students Not Ready for Instruction scale, in Australia, by school socioeconomic composition

CHAPTER 8

STUDENT ATTITUDES AND ASPIRATIONS

KEY FINDINGS

All key findings relate to Australian Year 4 and Year 8 students, except when comparisons to the international averages are being made.

- ▶ In general, students who indicated that they liked mathematics or science, were confident learning it and valued it, scored higher on average in the assessments than students who did not.
- ▶ Students generally showed quite negative attitudes towards mathematics, particularly at Year 8. Attitudes towards science were slightly less negative.
- ▶ 26% of Year 4 students and 50% of Year 8 students reported that they *do not like* learning mathematics, while 16% of Year 4 students and 28% of Year 8 students reported that they *do not like* learning science.
- ▶ 25% of Year 4 students and 44% of Year 8 students reported that they were *not confident* in mathematics, while 21% of Year 4 students and 45% of Year 8 students reported that they were *not confident* in science.
- ▶ Australian Year 8 students tended to value mathematics, with 86% valuing or strongly valuing mathematics (similar to the international average). However, levels of valuing science were lower, with 70% of Australian Year 8 students valuing or strongly valuing science, compared to the international average of 78%.
- ▶ On average, male students liked mathematics and science more than female students, they were more confident learning these subjects, and valued them more. However, female students who had the same level of confidence, liking or valuing of mathematics or science as male students scored at the same level, or higher than, their male peers.
- ▶ At Year 4, 35% of female students and 44% of male students reported that they *very much like* learning mathematics. At Year 8, this declined to just 10% of female students and 17% of male students. At the same time, at Year 4, 27% of female students and 25% of male students reported that they *do not like* learning mathematics, and by Year 8 this had increased to 57% of female students and 44% of male students.
- ▶ The differences between advantaged and disadvantaged students were quite stark. Disadvantaged students liked mathematics and science less, they were less confident and they valued mathematics and science to a lesser extent than did their advantaged peers.
- ▶ Female students held higher ambitions than male students, with a greater percentage aiming for university study. Students from advantaged backgrounds were far more likely to aspire to university than those from disadvantaged backgrounds, with the majority of those from disadvantaged backgrounds expecting that the completion of secondary school would be the highest education level they would achieve. The proportion of disadvantaged students aspiring to attend university has declined sharply since TIMSS 2015, from 16% to 8% of students.

Results in this chapter presented in figures (rather than tables) are given without standard errors. The same data are presented with standard errors in the Chapter 8 section of the Appendices.

Internationally and in Australia, there is continuing concern about declining enrolments in science, technology, engineering and mathematics (STEM) courses and participation in STEM careers. Developing positive attitudes towards mathematics and science is an important goal of the curriculum in many countries, as positive attitudes have been shown to be important not only for achievement but also in students' decisions to continue studying these subjects (Wang & Degol, 2013).

To summarise information about progress towards these goals, TIMSS 2019 examined students' general attitudes towards mathematics and science, and reports on the value that students place on mathematics and science as a way of improving their lives, and their academic self-confidence.

8.1 Students like learning mathematics

TIMSS 2019 collected data on how students felt about learning mathematics. Students were asked to indicate their level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements:

- ▶ I enjoy learning mathematics.
- ▶ I wish I did not have to study mathematics. (reverse scored)
- ▶ Mathematics is boring. (reverse scored)
- ▶ I learn many interesting things in mathematics.
- ▶ I like mathematics.
- ▶ I like any schoolwork that involves numbers.
- ▶ I like to solve mathematics problems.
- ▶ I look forward to mathematics class.
- ▶ Mathematics is one of my favourite subjects.

Responses to these nine statements were combined to create the Students Like Learning Mathematics scale. Students were then assigned to three groups based on their scale scores.

At Year 4, students who *very much like* learning mathematics had a scale score of at least 10.2, which corresponded to their 'agreeing a lot' with five of the items and 'agreeing a little' with the other four, on average. Students who *do not like* learning mathematics had a scale score no higher than 8.4, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the remaining four, on average. All other students *somewhat like* learning mathematics.

At Year 8, students who *very much like* learning mathematics had a scale score of at least 11.4, which corresponded to their 'agreeing a lot' with five of the items and 'agreeing a little' with the other four, on average. Students who *do not like* learning mathematics had a scale score no higher than 9.4, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the remaining four. All other students *somewhat like* learning mathematics.

Findings for Australia and other countries

Figure 8.1 shows the percentages of Year 4 and Year 8 students in each of the three categories of the Students Like Learning Mathematics scale, and their associated scores in mathematics in each category. The positive relationship between liking mathematics and scoring well can clearly be seen for both Year 4 and Year 8 students.

Year 4 students were mostly positive about learning mathematics, although not as positive as on average internationally. Forty per cent of Year 4 students reported that they *very much like* learning mathematics with an associated achievement score of 536 points. Internationally, 45% of Year 4 students were placed in this category, which was significantly different. In a few countries, most students reported that they *very much like* learning mathematics, the most striking of these being Albania (83%) and Kosovo (78%). In Singapore, the highest performing country in TIMSS 2019, 37% of students were in this category, which was significantly lower than the proportion in Australia.

Approximately 25% of Australian Year 4 students, however, reported that they *do not like* learning mathematics. This was similar to the percentage in Singapore (23%) and significantly higher than the international average (20%).

Over the four years between Year 4 and Year 8, attitudes deteriorated. Just 13% of Australian Year 8 students said that they *very much like* learning mathematics, 37% *somewhat like* learning mathematics and 50% *do not like* learning mathematics. For the international averages, 20% of students reported that they *very much like* learning mathematics. Singapore's percentage was 24%, while Egypt, which was a low-scoring country, had the highest proportion of students who *very much like* learning mathematics (42%).

Unfortunately, the stakes were somewhat higher for students at this year level, in that the relationship between liking mathematics and achievement was stronger. At Year 4, the correlation in Australia between liking mathematics and achievement was 0.24, while at Year 8 it was substantially higher at 0.39. Of course, the effect is likely to be reciprocal, in that the less a student enjoys doing mathematics, the less likely they are to put the time and energy into becoming better at it. Students who *very much like* learning mathematics scored, on average, 49 points more at Year 4 and 87 points more at Year 8 than those who *did not like* learning mathematics.

FIGURE 8.1 The Students Like Learning Mathematics scale and student achievement in mathematics, Australia and the international averages

Findings for male and female students

Figure 8.2 shows the percentages of students in each category of the Students' Like Learning Mathematics scale for male and female Australian students.

The pattern for male and female students in terms of their attitudes was the same in each year level, though more amplified at Year 8. At Year 4, 35% of female students compared to 44% of male students reported that they *very much like* learning mathematics. These proportions fell to just 10% of female students and 17% of male students in Year 8. At both year levels, the differences between female and male students were significant and both declines were significant.

At the other end of the scale, at Year 4, 27% of female students and 25% of male students reported that they *do not like* learning mathematics. By Year 8, these proportions had increased to 57% of female students and 44% of male students. While there was no difference between the proportions of Year 4 male and female students who reported not liking mathematics, the difference at Year 8 level was substantial and significant.

These findings are alarming. For only 10% of female and 17% of male Year 8 students to say that they *very much like learning* mathematics is worrying, but added to this is the proportion of all students, and most particularly female students, who report that they *do not like* learning mathematics is enormously problematic when trying to engage students with STEM subjects and STEM careers.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.2 The Students Like Learning Mathematics scale, in Australia (males and females)

Socioeconomic differences

For Year 4 students in TIMSS 2019, books in the home was the proxy measure for socioeconomic background. This is categorised as *a few books*, which is considered representative of disadvantaged background, an *average number of books*, representing average socioeconomic background, and *many books*, representing an advantaged background.

As has been described in Volume I, more data were able to be collected from the Year 8 students and consequently a more detailed scale was developed. The Home Educational Resources scale, as described in the Reader's Guide, included parents' educational background and the presence of home study supports including books. The three categories used for these analyses were *few resources*, representing disadvantaged background, *some resources*, representing average socioeconomic background, and *many resources*, representing an advantaged background. Past cycles of TIMSS have found achievement in mathematics and science to be strongly correlated with both books in the home and home education resources.

Figure 8.3 shows the percentages of students in each category of the Students' Like Learning Mathematics scale by student-level socioeconomic background.

At Year 4, there was little difference in socioeconomic background in the proportions of students who reported that they *do not like* learning mathematics – 26% were in the highest socioeconomic group compared to 29% in the lowest group. There was also little difference at the other end of the scale; 40% of students in the disadvantaged group and 42% of students in the advantaged group reported that they *very much like* learning mathematics. However, there were strong socioeconomic differences at Year 8, with 55% of students from a disadvantaged background reporting that they *do not like* learning mathematics compared to 41% from an advantaged background.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.3 The Students Like Learning Mathematics scale, in Australia, by student socioeconomic background

8.2 Students like learning science

As for mathematics, a Students Like Learning Science scale was created based on students' level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements about science:

- ▶ I enjoy learning science.
- ▶ I wish I did not have to study science. (reverse scored)
- ▶ Science is boring. (reverse scored)
- ▶ I learn many interesting things in science.
- ▶ I like science.
- ▶ I look forward to learning science in school.
- ▶ Science teaches me how things in the world work.
- ▶ I like to conduct science experiments.
- ▶ Science is one of my favourite subjects.

Responses to these nine statements were combined to create the Students Like Learning Science scale. Students were then assigned to three groups based on their scale scores.

At Year 4, students who *very much like* learning science had a scale score of at least 9.7, which corresponded to their 'agreeing a lot' with five of the items and 'agreeing a little' with the other four, on average. Students who *do not like* learning science had a scale score that was no higher than 7.6, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the remaining four, on average. All other students *somewhat like* learning science.

At Year 8, students who *very much like* learning science had a scale score of at least 10.6, which corresponded to their 'agreeing a lot' with five of the items and 'agreeing a little' with the other four, on average. Students who *do not like* learning science had a scale score that was no higher than 8.3, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the remaining four, on average. All other students *somewhat like* learning science.

Findings for Australia and other countries

Figure 8.4 shows the percentages of Year 4 and Year 8 students in each of the three categories of the Students Like Learning Science scale, and their associated scores in science in each category.

At Year 4, 50% of Australian students said that they *very much like* learning science, a proportion similar to the international average (52%) and Singapore (56%). However, as with mathematics, the degree of liking science declined significantly over the subsequent four years. By Year 8, the percentage of Australian students who *very much like* science was significantly lower (27%). The international average was 35%, which was similar to Singapore (37%). Jordan had the highest percentage of students in this category (56%).

Only 16% of Australian students at Year 4 level reported that they *do not like* learning science, and while this proportion increased to 28% of students at Year 8, it was much lower than the 50% of Year 8 students who reported that they *do not like* learning mathematics.

While the correlation between achievement and liking science in Australia was quite weak at Year 4 (0.10) and the score difference between those who *very much like* and those who *do not like* learning science was 24 points, at Year 8 level it was moderate (0.33) and the score difference was 70 points. These differences were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.4 The Students Like Learning Science scale and student achievement in science, Australia and the international averages

Findings for male and female students

Figure 8.5 shows the percentages of students in each category of the Students' Like Learning Science scale for male and female Australian students.

The pattern in student attitudes was the same for each year level, though much stronger at Year 8. At Year 4, similar proportions of female and male students *very much like* learning science (48% female students; 52% male students), but these proportions fell to just 23% of female students and 31% of male students in Year 8.

At Year 4, just 15% of female students and 18% of male students said that they *do not like* learning science. By Year 8, these proportions had increased to 32% of female students and 24% of male students, which was a significant difference. Summing up, a significantly higher percentage of female than male students said they *do not like* learning science, and a significantly higher percentage of male than female students expressed that they *very much like* learning science.

These percentages are not as concerning as was reported for mathematics, however, they still could have important implications for students' engagement with later STEM study and STEM careers.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.5 The Students Like Learning Science scale, in Australia (males and females)

Socioeconomic differences

Figure 8.6 shows the percentages of students in each category of the Students' Like Learning Science scale by student-level socioeconomic background.

At Year 4, there was little difference in the proportions of students who reported that they *do not like* learning science (14% of advantaged students compared to 18% of disadvantaged students). There was also little difference at the other end of the scale, with 48% of disadvantaged and 54% of advantaged students reporting that they *very much like* learning science. However, there were strong socioeconomic differences at Year 8, with the proportion who *do not like* science rising to 39% of students from a disadvantaged background and 20% from an advantaged background. The differences between advantaged and disadvantaged students in the percentage who *very much like* learning science and the percentage who *do not like* learning science were statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.6 The Students Like Learning Science scale, in Australia, by student socioeconomic background

8.3 Students' self-confidence in mathematics

TIMSS 2019 collected data on students' attitudes about their mathematics abilities. Students were asked to indicate their level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements:

- ▶ I usually do well in mathematics.
- ▶ Mathematics is more difficult for me than for many of my classmates. (reverse scored)
- ▶ Mathematics is not one of my strengths. (reverse scored)
- ▶ I learn things quickly in mathematics.
- ▶ Mathematics makes me nervous. (reverse scored)
- ▶ I am good at working out difficult mathematics problems.
- ▶ My teacher tells me I am good at mathematics.
- ▶ Mathematics is harder than any other subject for me.
- ▶ Mathematics makes me confused. (reverse scored)

Responses to these nine statements were combined to create the Students' Confidence in Mathematics scale. Students were then assigned to three groups based on their scale scores.

At Year 4, students who were *very confident* in mathematics had a scale score of at least 10.7, which corresponded to their 'agreeing a lot' with five of the nine statements and 'agreeing a little' with the other four, on average. Students who were *not confident* in mathematics scored no higher than 8.5 on the scale, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the other four, on average. All other students were classified as *somewhat confident* in mathematics.

At Year 8, students who were *very confident* in mathematics had a scale score of at least 12.1, which corresponded to their 'agreeing a lot' with five of the nine statements and 'agreeing a little' with the other four, on average. Students who were *not confident* in mathematics scored no higher than 9.5 on the scale, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the other four, on average. All other students were classified as *somewhat confident* in mathematics.

Findings for Australia and other countries

Figure 8.7 shows the percentages of Year 4 and Year 8 students in each of the three categories of Students' Confidence in Mathematics scale, and their associated scores in mathematics in each category.

Year 4 students were reasonably confident about learning mathematics, although not as confident as the international average. Twenty-nine per cent of Australian students reported they were *very confident* in mathematics and had an associated achievement score of 568 points. For the international average, a significantly higher 32% of Year 4 students reported a high degree of confidence in mathematics. Montenegro had 52% of *very confident* Year 4 students and was the country with the highest proportion of students in this category. Twenty-five per cent of Australian Year 4 students, however, reported that they were *not confident* in mathematics, and this was significantly higher than the international average of 23% of students.

Just 14% of Australian Year 8 students said that they were *very confident* in mathematics, and 44% reported that they were *not confident* in mathematics. Internationally, 15% of students were *very confident* in mathematics; in Singapore, 12% of students reported being *very confident*, and in Israel, the country with the highest proportion of students in this category, 25% of Year 8 students were *very confident* in mathematics.

The correlations between achievement and self-confidence were moderate-to-large for mathematics: 0.44 for Year 4 students and 0.49 for Year 8 students. Students who were *very confident* in mathematics scored, on average, 103 points more at Year 4 and 120 points more at Year 8 than those who were not.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.7 The Students' Confidence in Mathematics scale and student achievement in mathematics, Australia and the international averages

Findings for male and female students

Figure 8.8 shows the percentages of students in each category of the Students' Confidence in Mathematics scale for male and female Australian students.

Across Year 4 and Year 8, there were substantial and significant differences in the level of confidence reported by male and female students. At Year 4, 22% of female students and 35% of male students reported that they were *very confident* in mathematics. At Year 8, these proportions dropped to just 9% of female students and 18% of male students. At the other end of the scale, 30% of female students and 20% of male students in Year 4 reported that they were *not confident* in mathematics, with the proportions rising to 52% and 36%, respectively, at Year 8.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.8 The Students' Confidence in Mathematics scale, in Australia (males and females)

Socioeconomic differences

Figure 8.9 shows the percentages of students in each category of the Students' Confidence in Mathematics scale by student-level socioeconomic background.

At Year 4, students from a disadvantaged background exhibited the lowest levels of self-confidence in mathematics; 32% reported that they were *not confident* in mathematics, compared to 23% of students in the average socioeconomic background category and 21% of those from an advantaged background. At Year 8, 62% of those in the disadvantaged group, 47% in the middle group and 34% of advantaged students reported that they were *not confident* in mathematics. At both Year 4 and Year 8, the difference between advantaged and disadvantaged students was statistically significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.9 The Students' Confidence in Mathematics scale, in Australia, by student socioeconomic background

8.4 Students' self-confidence in science

Similar to mathematics, a Students' Confidence in Science scale was created, based on students' level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements about science:

- ▶ I usually do well in science.
- ▶ Science is more difficult for me than for many of my classmates. (reverse scored)
- ▶ Science is not one of my strengths. (reverse scored)
- ▶ I learn things quickly in science.
- ▶ I am good at working out difficult science problems. (Year 8 only)
- ▶ My teacher tells me I am good at science.
- ▶ Science is harder than any other subject for me.
- ▶ Science makes me confused. (reverse scored)

Responses to these eight statements were combined to create the Students' Confidence in Science scale. Students were then assigned to three groups based on their scale scores.

At Year 4, students who were *very confident* in science had a scale score of at least 10.2, which corresponded to their 'agreeing a lot' with four of the seven statements and 'agreeing a little' with the other three, on average. Students who were *not confident* in science had a score no higher than 8.2, which corresponded to their 'disagreeing a little' with four of the seven statements and 'agreeing a little' with the remaining three, on average. All other students were assigned to the *somewhat confident* in science category.

At Year 8, students who were *very confident* in science had a scale score of at least 11.3, which corresponded to their 'agreeing a lot' with four of the eight statements and 'agreeing a little' with the other four, on average. Students who were *not confident* in science had a score no higher than 9.2, which corresponded to their 'disagreeing a little' with four of the eight statements and 'agreeing a little' with the remaining four. All other students were assigned to the *somewhat confident* in science category.

Findings for Australia and other countries

Figure 8.10 shows the percentages of Year 4 and Year 8 students in each of the three categories of Students' Confidence in Science scale, and their associated scores in science in each category.

Thirty-two per cent of Australian Year 4 students reported that they were *very confident* in science. Internationally, a significantly higher 38% of students reported that they were *very confident* in science, and in Albania, the country with the highest proportion in this category, 60% of Year 4 students reported being *very confident* in science. Twenty-one per cent of Australian Year 4 students reported that they were *not confident* in science, which was significantly higher than the international average of 19% of students.

Just 16% of Australian Year 8 students said that they were *very confident* in science, with a further 39% in the middle category and 45% reporting that they were *not confident* in science. Internationally, 23% of students were *very confident* in science compared to 17% in Singapore. Iran had the highest proportion of *very confident* Year 8 students in this category (38%).

As was found for other variables, the relationship between self-confidence in science and achievement was stronger at Year 8 (0.35) than at Year 4 (0.19). Of course, the effect is likely to be reciprocal, in that the more confidence a student has in performing well in science (or mathematics), the more likely they are to put the time and energy into practising it. Students who were *very confident* in science scored, on average, 45 points more at Year 4 and 87 points more at Year 8 than those who were not.

FIGURE 8.10 The Students' Confidence in Science scale and student achievement in science, Australia and the international averages

Findings for male and female students

Figure 8.11 shows the percentages of students in each category of the Students' Confidence in Science scale for male and female Australian students.

At Year 4, there were no sex differences in science self-confidence. At Year 8, however, there were substantial and significant differences in the level of confidence of male and female students. At Year 4, 32% of female students and 33% of male students reported that they were *very confident* in science. At Year 8, these proportions dropped to just 13% of female students and 20% of male students. At the other end of the scale, 21% of both female and male students in Year 4 reported being *not confident* in science, rising to 50% of female students and 40% of male students at Year 8.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.11 The Students' Confidence in Science scale, in Australia (males and females)

Socioeconomic differences

Figure 8.12 shows the percentages of students in each category of the Students' Confidence in Science scale by student-level socioeconomic background.

At Year 4, there was a significant difference in the percentage of students expressing that they were *not confident* in science according to socioeconomic background. Twenty-five per cent of those from a disadvantaged background, compared with 20% of those in the middle and 17% of advantaged students, expressed this lack of confidence.

However, at Year 8, these proportions had grown dramatically, with 66% of disadvantaged students, 48% of those in the middle group and 32% of advantaged students reporting that they were *not confident* in learning science.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.12 The Students' Confidence in Science scale, in Australia, by student socioeconomic background

8.5 Students' valuing of mathematics

TIMSS 2019 collected data on the value that students attached to mathematics. Year 8 students were asked to indicate their level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements:

- ▶ I think learning mathematics will help me in my daily life.
- ▶ I need mathematics to learn other school subjects.
- ▶ I need to do well in mathematics to get into the university of my choice.
- ▶ I need to do well in mathematics to get the job I want.
- ▶ I would like a job that involves using mathematics.
- ▶ It is important to learn about mathematics to get ahead in the world.
- ▶ Learning mathematics will give me more job opportunities when I am an adult.
- ▶ My parents think that it is important that I do well in mathematics.
- ▶ It is important to do well in mathematics.

Responses to these nine statements were combined to create the Students Value Mathematics scale. Students were then assigned to three groups based on their scale scores.

Students who *strongly value* mathematics had a scale score of at least 10.3, which corresponded to their 'agreeing a lot' with five of the nine statements and 'agreeing a little' with the other four, on average. Students who *do not value* mathematics, in contrast, had a scale score no higher than 7.8, which corresponded to their 'disagreeing a little' with five of the statements and 'agreeing a little' with the other four, on average. All other students were assigned to the *somewhat value* mathematics group.

Findings for Australia and other countries

Figure 8.13 shows the percentages of Year 8 students in each of the three categories of Students Value Mathematics scale, and their associated scores in mathematics in each category.

Australian students were very near the international average on this index. Thirty-eight per cent reported that they *strongly value* mathematics with an associated average achievement score of 539 points. The international average was 37% and in South Africa, the country with the highest proportion in this category, 68% of Year 8 students *strongly value* mathematics and had an average achievement score of 399 points.

Just 14% of Australian Year 8 students reported that they *do not value* mathematics, which was similar to the international average of 16% of students.

The correlation between valuing mathematics and achievement was small but significant, at 0.22. Australian students who *strongly value* mathematics scored, on average, 60 points higher than students who *do not value* mathematics.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.13 The Students Value Mathematics scale and student achievement in mathematics, Australia and the international averages

Findings for male and female students

Figure 8.14 shows the percentages of Year 8 students in each category of the Students Value Mathematics scale for male and female Australian students.

There were some fairly substantial and significant differences in the degree to which male and female students valued mathematics. Thirty-four per cent of female students compared to 42% of male students, said that they *strongly value* mathematics, while 15% of female students and 13% of male students reported that they *do not value* mathematics. Both differences were significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.14 The Students Value Mathematics scale, in Australia (males and females)

Socioeconomic differences

Figure 8.15 shows the percentages of students in each category of the Students' Value Mathematics scale by student-level socioeconomic background.

Valuing mathematics certainly seems to be strongly associated with socioeconomic background – just 24% of students from a disadvantaged background said that they *strongly value* mathematics, compared to 47% of students from an advantaged background. The reverse was also seen, with 22% of students from a disadvantaged background – compared to 10% of advantaged students – reporting that they *do not value* mathematics. These differences were statistically significant.

Students' valuing of mathematics and resources in the home

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.15 The Students Value Mathematics scale, in Australia, by student socioeconomic background

8.6 Students' valuing of science

Similar to mathematics, a Students Value Science scale was created, based on Year 8 students' level of agreement ('agree a lot', 'agree a little', 'disagree a little' or 'disagree a lot') with each of the following statements about science:

- ▶ I think learning science will help me in my daily life.
- ▶ I need science to learn other school subjects.
- ▶ I need to do well in science to get into the university of my choice.
- ▶ I need to do well in science to get the job I want.
- ▶ I would like a job that involves using science.
- ▶ It is important to learn about science to get ahead in the world.
- ▶ Learning science will give me more job opportunities when I am an adult.
- ▶ My parents think that it is important that I do well in science.
- ▶ It is important to do well in science.

Responses to these nine statements were combined to create the Students Value Science scale. Students were then assigned to three groups based on their scale scores.

For general or integrated science (as is taught in Australia), students who *strongly value* science had a scale score of at least 10.6, which corresponded to their 'agreeing a lot' with five of the nine statements and 'agreeing a little' with the remaining four, on average. Students who *do not value* science had a score no higher than 8.5, which corresponded to their 'disagreeing a little' with five of the nine statements and 'agreeing a little' with the other four, on average. All other students were assigned to the *somewhat value* science category.

Findings for Australia and other countries

Figure 8.16 shows the percentages of Year 8 students in each of the three categories of Students' Value Science scale, and their associated achievement in science.

Australian Year 8 students were below the average internationally. Just 28% of Australian students reported that they *strongly value* science, with an associated average achievement score of 561 points. The international average was 36% of Year 8 students, and in Egypt, the country with the highest proportion in this category, 67% of Year 8 students *strongly value* science. Twenty-nine per cent of Australian Year 8 students reported that they *do not value* science, a proportion significantly larger than the international average of 22% of students.

The correlation between valuing science and achievement was small to moderate at 0.28. Australian students who *strongly value* science scored, on average, 60 points higher than students who *do not value* science.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.16 The Students Value Science scale and student achievement in science, Australia and the international averages

Findings for male and female students

Figure 8.17 shows the percentages of students in each category of the Students Value Science scale for male and female Australian students.

Twenty-six per cent of female students and 31% of male students said that they *strongly value* science, while 31% of female students and 27% of male students reported that they *do not value* science. Both of these differences were significant.

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.17 The Students Value Science scale, in Australia (males and females)

Socioeconomic differences

Figure 8.18 shows the percentages of students in each category of the Students Value Science scale by student-level socioeconomic background.

There are large and significant differences in the valuing of science by socioeconomic background – 39% of disadvantaged students *do not value* science compared to 18% of advantaged students, while just 15% of disadvantaged students compared to 41% of advantaged students *strongly value* science.

Students' valuing of science and resources in the home

Note: Due to rounding, totals may not add to 100%.

FIGURE 8.18 The Students Value Science scale, in Australia, by student socioeconomic background

8.7 Students' educational aspirations

Table 8.1 shows the percentage of Australian Year 8 students according to the highest education level that they thought they would achieve, as well as average mathematics and science achievement.

Fifty-three per cent of Australian students expected to attend university, with 23% expecting to earn a postgraduate qualification (including a doctorate, master's or other postgraduate degree or diploma).

A further 21% of students expected to gain some form of post-school qualification (such as an apprenticeship, traineeship or TAFE qualification), but did not expect to attend university.

TABLE 8.1 Australian Year 8 students' educational aspirations and achievement in mathematics and science

	Postgraduate degree						University but not postgraduate degree					
	Students (%)	SE	Average mathematics achievement		Average science achievement		Students (%)	SE	Average mathematics achievement		Average science achievement	
			Mean	SE	Mean	SE			Mean	SE	Mean	SE
Australia	23	0.9	567	5.3	569	4.3	30	0.8	549	3.6	560	3.3
Female	24	1.0	555	5.2	559	5.1	36	1.1	539	3.9	552	3.5
Male	22	1.4	580	7.6	579	5.8	24	1.0	565	6.0	572	5.6
Few resources	12	2.2	468	16.2	456	21.9	8	2.0	457	20.9	460	19.9
Some resources	18	1.0	554	4.9	552	4.0	28	0.9	540	3.5	549	3.5
Many resources	39	1.4	588	7.1	596	5.7	38	1.3	571	4.9	588	4.0

	Post-secondary but not university						Upper secondary education or less					
	Students (%)	SE	Average mathematics achievement		Average science achievement		Students (%)	SE	Average mathematics achievement		Average science achievement	
			Mean	SE	Mean	SE			Mean	SE	Mean	SE
Australia	21	0.8	500	3.0	518	2.7	26	1.0	459	3.5	473	3.6
Female	19	1.0	494	3.8	515	3.4	21	1.1	456	3.6	473	4.2
Male	24	1.2	505	4.1	520	3.8	30	1.5	462	4.8	474	5.0
Few resources	18	2.6	449	14.0	453	13.3	62	3.6	413	8.3	421	9.1
Some resources	24	1.0	498	3.0	514	2.9	30	1.1	460	3.5	473	3.8
Many resources	13	1.3	524	6.8	553	6.5	10	0.9	499	6.8	525	6.2

Note: Due to rounding, totals may not add to 100%.

Differences between female and male students

Substantial differences between female and male students were evident. Overall, female students were more ambitious than male students, with 36% expecting to gain an undergraduate university degree compared to 24% of male students. Interestingly, while this difference was significant, there was no difference in the proportions of male and female students expecting to gain a postgraduate degree (24% of females and 22% of males).

Significantly more male students than female students expressed lower ambitions – gaining a TAFE or other post-secondary qualification, or simply completing secondary school.

Socioeconomic differences

There were striking differences in aspirations by socioeconomic background. Seventy-seven per cent of students from an advantaged background expected to attend university, compared to 20% of those from a disadvantaged background. This latter proportion has declined from 28% in TIMSS 2015, with the decline particularly evident in the percentage of students from more disadvantaged backgrounds aiming for undergraduate university degrees. This has also declined for disadvantaged students from 16% in 2015 to 8% of students in 2019.

A growing number of disadvantaged students, 62% in TIMSS 2019 compared to 52% in TIMSS 2015, planned simply to complete upper secondary school, or lower, while 18% considered TAFE or other post-secondary courses. In comparison, 10% of students from an advantaged background intended only to complete secondary school and 13% considered TAFE or other post-secondary courses, proportions that were largely unchanged from TIMSS 2015.

APPENDICES

CHAPTER 2 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 2. Due to rounding, totals may not round to 100%.

A2.1 Socioeconomic composition of schools and student achievement in mathematics and science, Australia and the international averages

	School socioeconomic composition											
	More affluent				Neither more affluent nor more disadvantaged				More disadvantaged			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	34	3.5	542	4.4	38	3.8	512	5.0	28	3.4	485	8.0
International average	41	0.5	521	1.3	34	0.5	499	0.9	25	0.4	479	1.1
Year 4 science												
Australia	34	3.5	557	3.8	38	3.8	530	4.1	28	3.4	504	6.6
International average	41	0.5	512	1.3	34	0.5	489	1.0	25	0.4	467	1.1
Year 8 mathematics												
Australia	39	3.6	558	7.8	34	3.4	511	5.5	27	3.0	474	5.8
International average	35	0.5	518	1.3	33	0.6	489	1.1	32	0.5	466	1.2
Year 8 science												
Australia	39	3.6	565	6.0	34	3.4	525	4.3	27	3.0	487	5.6
International average	35	0.5	518	1.3	33	0.6	490	1.2	32	0.5	468	1.3

A2.2 Socioeconomic composition of schools, in Australia, by school geographic location

	School socioeconomic composition and school geographic location					
	More affluent		Neither more affluent nor more disadvantaged		More disadvantaged	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Major cities	37	4.2	39	4.6	24	3.9
Regional and remote areas	24	6.2	35	7.5	41	7.3
Year 8						
Major cities	47	4.0	32	3.9	21	2.4
Regional and remote areas	20	5.9	37	7.2	43	8.1

A2.3 Language background of schools' populations and student achievement in mathematics and science, Australia and the international averages

Students have the language of test as their native language												
90% or more				Between 51 to 90%				50% or fewer				
Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	
Year 4 mathematics												
Australia	48	3.5	516	4.4	34	3.8	514	5.2	17	3.0	513	13.4
International average	63	0.4	506	0.6	18	0.4	501	1.5	19	0.3	486	1.5
Year 4 science												
Australia	48	3.5	537	4.1	34	3.8	530	4.5	17	3.0	522	11
International average	63	0.4	498	0.7	18	0.4	493	1.5	19	0.3	471	1.5
Year 8 mathematics												
Australia	56	3.8	506	4.2	31	3.5	530	8.8	13	2.8	548	16.7
International average	64	0.5	487	0.8	17	0.4	484	2.1	18	0.3	483	2.3
Year 8 science												
Australia	56	3.8	525	3.6	31	3.5	536	7.5	13	2.8	540	14.8
International average	64	0.5	490	0.8	17	0.4	491	2.3	18	0.3	479	2.4

A2.4 Language background of schools' populations, in Australia, by school socioeconomic composition

Students have the language of test as their native language and school socioeconomic composition						
90% or more		Between 51 to 90%		50% or fewer		
Students (%)	SE	Students (%)	SE	Students (%)	SE	
Year 4						
More affluent	58	6.0	35	6.0	8	3.4
Neither more affluent nor more disadvantaged	45	6.8	34	6.5	21	5.8
More disadvantaged	39	6.5	35	7.5	26	6.2
Year 8						
More affluent	58	6.8	30	6.1	12	4.4
Neither more affluent nor more disadvantaged	59	6.0	29	6.0	12	4.9
More disadvantaged	48	7.7	35	7.5	17	6.6

A2.5 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale and student achievement in mathematics and science, Australia and the international averages

Students enter school with skills												
75% or more				Between 25% & 75%				25% or fewer				
Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	
Year 4 mathematics												
Australia	9	2.1	526	9.3	43	3.4	530	4.8	47	3.3	498	4.6
International average	24	0.4	508	1.5	56	0.5	499	0.6	20	0.4	480	1.4
Year 4 science												
Australia	9	2.1	548	7.0	43	3.4	545	4.3	47	3.3	517	4.0
International average	24	0.4	499	1.6	56	0.5	490	0.7	20	0.4	471	1.6

A2.6 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale, in Australia, by school socioeconomic composition

Students enter school with skills and school socioeconomic composition						
75% or more		Between 25% & 75%		25% or fewer		
Students (%)	SE	Students (%)	SE	Students (%)	SE	
Year 4						
More affluent	14	4.3	54	6.2	32	6.6
Neither more affluent nor more disadvantaged	10	3.7	42	6.7	48	6.9
More disadvantaged	3	2.1	29	6.2	67	6.5

A2.7 The Schools Where Students Enter the Primary Grades with Literacy and Numeracy Skills scale, in Australia, by school geographic location

Students enter school with skills and school geographic location						
75% or more		Between 25% & 75%		25% or fewer		
Students (%)	SE	Students (%)	SE	Students (%)	SE	
Year 4						
Major cities	10	2.7	46	4.1	44	4.0
Regional and remote areas	6	2.7	35	6.6	59	6.8

A2.8 The Mathematics Resource Shortages scale and student achievement in mathematics, Australia and the international averages

	Students affected by mathematics resource shortages											
	Not affected				Somewhat affected				Affected a lot			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	44	4.0	523	5.9	53	3.9	509	4.2	3	1.4	485	20.2
International average	26	0.4	514	1.3	68	0.5	499	0.6	6	0.2	473	3.2
Year 8 mathematics												
Australia	62	3.5	535	5.7	37	3.5	493	4.8	2	1.2	~	~
International average	30	0.5	509	1.6	63	0.6	483	0.7	7	0.3	476	4.1

~ Insufficient data to report achievement in this category.

A2.9 The Mathematics Resource Shortages scale, in Australia, by school socioeconomic composition

	Students affected by mathematics resource shortages and school socioeconomic composition					
	Not affected		Somewhat affected		Affected a lot	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	53	6.6	44	6.5	3	2.5
Neither more affluent nor more disadvantaged	42	6.9	54	6.8	4	2.8
More disadvantaged	36	6.5	63	6.5	0	0.2
Year 8						
More affluent	76	6.2	24	6.2	0	0.0
Neither more affluent nor more disadvantaged	59	5.6	36	6.1	5	3.6
More disadvantaged	44	6.8	55	6.8	1	0.9

A2.10 The Science Resource Shortages scale and student achievement in science, Australia and the international averages

	Students affected by science resource shortages											
	Not affected				Somewhat affected				Affected a lot			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 science												
Australia	37	3.7	538	5.6	61	3.8	530	3.7	2	1.4	~	~
International average	24	0.4	508	1.4	69	0.5	488	0.6	7	0.3	472	3.0
Year 8 science												
Australia	63	3.4	542	4.6	35	3.4	510	4.6	2	1.2	~	~
International average	30	0.5	510	1.7	62	0.6	484	0.8	8	0.3	472	4.1

~ Insufficient data to report achievement in this category.

A2.11 The Science Resource Shortages scale, in Australia, by school socioeconomic composition

	Students affected by science resource shortages and school socioeconomic composition					
	Not affected		Somewhat affected		Affected a lot	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	48	7.6	50	7.6	3	2.5
Neither more affluent nor more disadvantaged	32	6.5	64	6.5	4	2.8
More disadvantaged	30	6.3	70	6.3	0	0.0
Year 8						
More affluent	78	6.2	22	6.2	0	0.0
Neither more affluent nor more disadvantaged	59	5.5	36	6.0	5	3.6
More disadvantaged	45	6.7	54	6.7	1	0.9

CHAPTER 3 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 3. Due to rounding, totals may not round to 100%.

A3.1 The School Emphasis on Academic Success scale and student achievement in mathematics and science, Australia and the international averages

	School emphasis on academic success											
	Very high				High				Medium			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	9	1.9	556	8.6	53	3.2	521	4.1	38	3.4	496	5.4
International average	7	0.3	515	2.1	55	0.5	508	0.7	37	0.5	486	0.8
Year 4 science												
Australia	9	1.9	568	7.8	53	3.2	537	3.7	38	3.4	516	4.5
International average	7	0.3	508	2.4	55	0.5	499	0.7	37	0.5	474	0.9
Year 8 mathematics												
Australia	17	2.8	587	8.8	46	3.5	525	5.4	37	3.0	480	5.6
International average	8	0.3	538	3.0	49	0.6	500	0.8	43	0.6	469	0.9
Year 8 science												
Australia	17	2.8	581	8.7	46	3.5	537	4.5	37	3.0	497	5.0
International average	8	0.3	538	2.6	49	0.6	501	0.8	43	0.6	470	1.0

A3.2 The School Emphasis on Academic Success scale, in Australia, by school socioeconomic composition

	School emphasis on academic success and school socioeconomic composition					
	Very high		High		Medium	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	18	5.2	58	6.2	24	5.5
Neither more affluent nor more disadvantaged	5	2.8	65	5.7	30	5.7
More disadvantaged	3	3.0	31	7.0	66	7.2
Year 8						
More affluent	31	6.1	58	6.2	11	4.0
Neither more affluent nor more disadvantaged	16	5.3	46	5.8	38	6.7
More disadvantaged	0	0.0	26	5.7	74	5.7

A3.3 The Students' Sense of School Belonging scale and student achievement in mathematics and science, Australia and the international averages

	Sense of school belonging											
	Very high				High				Medium			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	54	1.2	526	3.2	36	0.9	509	3.3	10	0.6	490	6.4
International average	58	0.2	508	0.5	34	0.1	498	0.6	8	0.1	484	0.9
Year 4 science												
Australia	54	1.2	541	2.9	36	0.9	528	2.7	10	0.6	510	5.6
International average	58	0.2	497	0.6	34	0.1	487	0.7	8	0.1	476	1.0
Year 8 mathematics												
Australia	30	0.9	548	4.6	50	0.8	516	4.1	20	0.9	476	4.1
International average	37	0.2	500	0.7	49	0.2	489	0.6	14	0.1	470	0.9
Year 8 science												
Australia	30	0.9	557	4.2	50	0.8	529	3.5	20	0.9	487	3.1
International average	37	0.2	502	0.7	49	0.2	490	0.6	14	0.1	470	1.0

A3.4 The Students' Sense of School Belonging scale, in Australia, by school socioeconomic composition

	Sense of school belonging and school socioeconomic composition					
	High		Some		Little	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	58	2.1	35	1.8	8	0.9
Neither more affluent nor more disadvantaged	53	2.3	36	1.6	11	1.4
More disadvantaged	54	2.3	37	1.9	10	0.9
Year 8						
More affluent	40	1.8	47	1.5	13	1.5
Neither more affluent nor more disadvantaged	27	1.3	53	1.5	20	1.9
More disadvantaged	21	1.7	50	1.9	28	2.6

A3.5 The School Discipline Problems scale and student achievement in mathematics and science, Australia and the international averages

	Severity of school discipline problems											
	Hardly any				Minor				Moderate to severe			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	57	3.5	529	4.0	40	3.4	500	4.8	3	1.3	442	15.7
International average	60	0.5	508	0.7	32	0.5	494	0.9	8	0.3	466	1.8
Year 4 science												
Australia	57	3.5	545	3.6	40	3.4	519	4.2	3	1.3	467	14.3
International average	60	0.5	498	0.8	32	0.5	483	1.0	8	0.3	457	1.9
Year 8 mathematics												
Australia	50	3.2	549	5.5	44	3.4	491	5.8	6	1.7	467	7.6
International average	45	0.6	503	1.0	43	0.6	481	1.0	11	0.4	448	2.1
Year 8 science												
Australia	50	3.2	556	4.1	44	3.4	506	5.1	6	1.7	482	7.7
International average	45	0.6	504	1.0	43	0.6	482	1.0	11	0.4	452	2.1

A3.6 The School Discipline Problems scale, in Australia, by school socioeconomic composition

	Severity of school discipline problems and school socioeconomic composition					
	Hardly any		Minor		Moderate to severe	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	82	3.1	18	3.1	0	0.0
Neither more affluent nor more disadvantaged	56	6.9	42	6.8	3	2.3
More disadvantaged	29	6.8	64	7.1	7	3.6
Year 8						
More affluent	73	5.7	27	5.7	0	0.2
Neither more affluent nor more disadvantaged	50	6.1	44	6.0	6	3.2
More disadvantaged	20	6.4	65	6.6	15	5.2

A3.7 The Safe and Orderly School scale and student achievement in mathematics and science, Australia and the international averages

	Safe and orderly school environment											
	Very				Somewhat				Less than			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	64	3.5	529	3.7	28	3.0	504	7.4	8	2.3	479	9.0
International average	61	0.4	507	0.6	36	0.4	495	0.9	4	0.2	495	2.4
Year 4 science												
Australia	65	3.5	544	3.0	26	2.9	518	6.1	8	2.3	497	5.8
International average	61	0.4	497	0.6	35	0.4	484	0.9	4	0.2	493	2.7
Year 8 mathematics												
Australia	59	3.0	535	5.9	35	2.9	502	6.4	6	1.7	472	19.9
International average	48	0.5	501	0.9	45	0.6	482	1.0	6	0.3	460	2.5
Year 8 science												
Australia	54	3.4	547	5.4	37	3.2	518	4.6	10	2.0	509	10.6
International average	49	0.5	501	0.9	45	0.5	483	1.0	6	0.3	466	2.5

A3.8 The Safe and Orderly School scale, in Australia, by school socioeconomic composition

	Safe and orderly school environment and school socioeconomic composition					
	Very		Somewhat		Less than	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4 mathematics						
More affluent	77	6.0	23	6.0	0	0.2
Neither more affluent nor more disadvantaged	64	5.3	32	5.2	3	2.0
More disadvantaged	39	7.3	42	7.1	19	6.6
Year 4 science						
More affluent	84	5.1	15	4.8	1	0.9
Neither more affluent nor more disadvantaged	63	5.6	31	5.6	6	2.2
More disadvantaged	40	7.1	43	6.9	17	6.6
Year 8 mathematics						
More affluent	76	4.5	22	5.0	2	1.8
Neither more affluent nor more disadvantaged	53	5.8	41	5.8	6	3.1
More disadvantaged	42	7.0	46	6.3	12	5.2
Year 8 science						
More affluent	68	5.9	27	5.2	5	2.4
Neither more affluent nor more disadvantaged	55	5.2	37	5.0	8	3.0
More disadvantaged	35	6.5	47	6.8	18	5.9

A3.9 The Student Bullying scale and student achievement in mathematics and science, Australia and the international averages

	Frequency of bullying at school											
	Never or almost never				About monthly				About weekly			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	54	1.3	525	3.1	39	1.0	513	3.4	7	0.6	470	6.2
International average	63	0.2	512	0.5	29	0.1	495	0.6	8	0.1	451	1.1
Year 4 science												
Australia	54	1.3	541	2.9	39	1.0	530	2.9	7	0.6	490	6.1
International average	63	0.2	503	0.5	29	0.1	486	0.7	8	0.1	437	1.2
Year 8 mathematics												
Australia	64	0.8	529	4.1	28	0.7	505	4.2	8	0.4	478	4.9
International average	71	0.2	496	0.6	23	0.1	482	0.8	6	0.1	428	1.5
Year 8 science												
Australia	64	0.8	540	3.4	28	0.7	517	3.7	8	0.4	487	5.0
International average	71	0.2	499	0.6	23	0.1	482	0.8	6	0.1	421	1.6

A3.10 The Student Bullying scale, in Australia, by school socioeconomic composition

	Frequency of bullying at school and school socioeconomic composition					
	Never or almost never		About monthly		About weekly	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	58	1.8	36	1.7	6	0.8
Neither more affluent nor more disadvantaged	52	2.5	40	2.0	8	1.0
More disadvantaged	54	2.4	39	2.0	7	1.1
Year 8						
More affluent	69	1.1	26	1.1	5	0.5
Neither more affluent nor more disadvantaged	65	1.6	27	1.3	9	0.7
More disadvantaged	57	1.6	32	1.6	11	1.2

A3.11 Frequency of student absences and student achievement in mathematics and science, Australia and the international averages

	Frequency of student absences											
	Never or almost never				Once every two months				Once a month			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	57	0.9	525	3.2	18	0.8	531	4.1	13	0.6	513	4.2
International average	61	0.2	512	0.5	13	0.1	509	0.7	10	0.1	495	0.8
Year 4 science												
Australia	57	0.9	538	2.5	18	0.8	549	4.4	13	0.6	536	4.2
International average	61	0.2	503	0.6	13	0.1	498	0.8	10	0.1	484	0.9
Year 8 mathematics												
Australia	46	1.1	535	4.2	23	0.7	524	4.9	17	0.6	509	4.6
International average	55	0.2	502	0.6	16	0.1	495	0.8	14	0.1	475	0.9
Year 8 science												
Australia	46	1.1	543	3.6	23	0.7	537	4.4	17	0.6	524	4.1
International average	55	0.2	504	0.6	16	0.1	497	0.8	14	0.1	479	0.9

	Frequency of student absences							
	Once every two weeks				Once a week			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics								
Australia	6	0.4	489	7.2	7	0.5	435	7.5
International average	5	0.1	462	1.2	11	0.1	448	0.8
Year 4 science								
Australia	6	0.4	508	7.2	7	0.5	460	6.8
International average	5	0.1	455	1.3	11	0.1	437	0.9
Year 8 mathematics								
Australia	8	0.4	477	4.8	5	0.4	439	6.8
International average	7	0.1	452	1.1	8	0.1	412	1.3
Year 8 science								
Australia	8	0.4	494	5.1	5	0.4	454	8.0
International average	7	0.1	457	1.2	8	0.1	413	1.4

A3.12 Frequency of student absences, in Australia, by school socioeconomic composition

Frequency of student absences and school socioeconomic composition										
	Never or almost never		Once every two month		Once a month		Once every two weeks		Once a week	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4										
More affluent	51	1.5	25	2.0	16	1.3	5	0.6	4	0.7
Neither more affluent nor more disadvantaged	60	1.6	15	1.1	13	1.2	6	0.8	7	0.8
More disadvantaged	61	1.8	12	1.1	11	0.9	6	0.7	10	1.2
Year 8										
More affluent	49	2.1	25	1.2	17	1.3	6	0.6	3	0.4
Neither more affluent nor more disadvantaged	45	1.9	23	1.3	19	1.1	8	0.7	5	0.7
More disadvantaged	41	2.3	22	1.2	18	1.3	12	1.0	8	1.0

A3.13 Students report arriving at school feeling tired and student achievement in mathematics and science, Australia and the international averages

Frequency of students arriving at school tired												
	Never				Sometimes				Daily or almost every day			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	13	0.7	519	5.3	53	1.0	528	3.3	34	1.1	499	3.1
International average	19	0.1	503	0.7	47	0.1	511	0.5	35	0.2	490	0.6
Year 4 science												
Australia	13	0.7	527	5.7	53	1.0	542	3.0	34	1.1	522	2.9
International average	19	0.1	490	0.8	47	0.1	501	0.6	35	0.2	481	0.6
Year 8 mathematics												
Australia	4	0.2	523	9.4	47	0.9	526	4.6	49	0.9	510	3.5
International average	8	0.1	488	1.3	47	0.2	493	0.6	45	0.2	487	0.6
Year 8 science												
Australia	4	0.2	526	9.3	47	0.9	536	3.8	49	0.9	523	3.1
International average	8	0.1	485	1.4	47	0.2	494	0.6	45	0.2	488	0.7

A3.14 Students report arriving at school feeling tired, in Australia, by school socioeconomic composition

	Frequency of students arriving at school tired and school socioeconomic composition					
	Never		Sometimes		Daily or almost every day	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	12	1.1	58	1.8	30	1.8
Neither more affluent nor more disadvantaged	12	1.1	52	1.4	37	1.7
More disadvantaged	14	1.3	50	1.9	36	1.7
Year 8						
More affluent	4	0.4	48	1.7	49	1.6
Neither more affluent nor more disadvantaged	4	0.5	50	1.6	46	1.7
More disadvantaged	6	0.7	44	1.4	50	1.8

A3.15 Students report arriving at school feeling hungry and student achievement in mathematics and science, Australia and the international averages

	Frequency of students arriving at school hungry											
	Never				Sometimes				Daily or almost every day			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4 mathematics												
Australia	30	1.1	541	4.2	43	0.9	522	3.0	28	1.0	486	3.5
International average	31	0.2	515	0.6	41	0.1	507	0.5	28	0.1	488	0.6
Year 4 science												
Australia	30	1.1	551	3.6	43	0.9	539	2.6	28	1.0	508	3.3
International average	31	0.2	504	0.6	41	0.1	497	0.6	28	0.1	478	0.7
Year 8 mathematics												
Australia	28	0.8	540	5.8	45	0.6	521	4.0	27	0.8	493	3.6
International average	25	0.1	504	0.8	42	0.1	492	0.6	33	0.2	480	0.7
Year 8 science												
Australia	28	0.8	553	5.1	45	0.6	532	3.2	27	0.8	502	3.4
International average	25	0.1	507	0.8	42	0.1	493	0.6	33	0.2	480	0.7

A3.16 Students report arriving at school feeling hungry, in Australia, by school socioeconomic composition

	Frequency of students arriving at school hungry and school socioeconomic composition					
	Never		Sometimes		Daily or almost every day	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	36	2.5	40	1.9	24	1.7
Neither more affluent nor more disadvantaged	27	1.9	44	1.9	29	1.7
More disadvantaged	27	1.8	39	1.5	34	2.0
Year 8						
More affluent	29	1.5	47	1.1	23	1.7
Neither more affluent nor more disadvantaged	27	1.4	45	1.2	28	1.2
More disadvantaged	27	1.5	42	1.4	31	1.4

CHAPTER 4 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 4. Due to rounding, totals may not add to 100%.

A4.1 Percentages of students by the type of major of mathematics teachers and student achievement in mathematics, Australia and the international averages

	Mathematics teachers' formal education							
	Major in education* and mathematics				Major in education but not mathematics			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	16	2.6	522	10.2	80	2.9	518	2.9
International average	32	0.4	497	1.1	43	0.4	503	1.4
Year 8								
Australia	46	3.1	531	8.6	17	2.9	511	10.7
International average	39	0.6	492	1.2	11	0.3	494	2.9

	Mathematics teachers' formal education							
	Major in mathematics but not education				All other majors			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	0	0.1	~	~	4	1.2	477	13.1
International average	11	0.3	487	2.6	8	0.3	490	2.7
Year 8								
Australia	14	2.2	523	9.8	23	2.3	501	6.7
International average	39	0.5	488	1.2	10	0.3	484	2.8

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'mathematics education'.

~ Insufficient data to report achievement in this category.

A4.2 Percentages of students by the type of major of mathematics teachers, in Australia, by school socioeconomic composition

	Mathematics teachers' formal education and school socioeconomic composition							
	Major in education* and mathematics		Major in education but not mathematics		Major in mathematics but not education		All other majors	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
More affluent	22	6.4	77	6.4	0	0.0	1	0.7
Neither more affluent nor more disadvantaged	13	3.6	81	4.7	0	0.0	6	3.2
More disadvantaged	18	5.5	80	5.6	0	0.0	3	1.4
Year 8								
More affluent	54	5.8	16	5.8	14	3.8	16	4.0
Neither more affluent nor more disadvantaged	51	5.9	13	4.2	9	2.6	26	5.0
More disadvantaged	31	6.2	23	5.9	18	4.7	28	5.2

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'mathematics education'.

A4.3 Percentages of students by the type of major of mathematics teachers, in Australia, by school geographic location

	Mathematics teachers' formal education and school geographic location							
	Major in education* and mathematics		Major in education but not mathematics		Major in mathematics but not education		All other majors	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Major cities	17	2.9	80	3.3	0	0.1	3	1.5
Regional and remote areas	13	5.6	83	6.1	0	0.1	4	2.0
Year 8								
Major cities	48	3.8	15	3.7	16	2.8	21	2.8
Regional and remote areas	41	6.3	24	4.2	9	3.6	25	4.4

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'mathematics education'.

A4.4 Percentages of students by mathematics teachers' area of professional development, Australia and the international averages

	Mathematics teachers' areas of professional development							
	Mathematics content		Mathematics pedagogy/instruction		Mathematics curriculum		Integrating technology into mathematics instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	56	3.7	54	3.4	53	3.4	30	3.3
International average	46	0.5	45	0.5	41	0.5	35	0.4
Year 8								
Australia	58	3.0	63	3.2	63	2.9	55	3.0
International average	57	0.6	60	0.6	53	0.6	51	0.6

	Mathematics teachers' areas of professional development					
	Improving students' critical thinking or problem-solving skills		Mathematics assessment		Addressing individual students' needs	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Australia	55	3.6	43	3.0	52	3.8
International average	44	0.5	37	0.0	43	0.5
Year 8						
Australia	58	3.7	52	3.0	60	3.2
International average	46	0.6	47	1.0	44	0.6

A4.5 Percentages of students by mathematics teachers' needs for future professional development, Australia and the international averages

Mathematics teachers' areas for future professional development								
	Mathematics content		Mathematics pedagogy/ instruction		Mathematics curriculum		Integrating technology into mathematics instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	43	3.7	54	3.7	40	3.5	78	2.8
International average	45	0.5	55	0.5	44	0.5	72	0.5
Year 8								
Australia	58	3.3	70	2.9	61	3.7	81	2.7
International average	47	0.6	60	0.6	49	0.6	71	0.6

Mathematics teachers' areas for future professional development						
	Improving students' critical thinking or problem-solving skills		Mathematics assessment		Addressing individual students' needs	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Australia	76	3.1	63	3.0	63	3.8
International average	69	0.5	54	0.0	64	0.5
Year 8						
Australia	84	2.2	71	3.0	77	3.2
International average	69	0.6	57	1.0	65	0.6

A4.6 The Mathematics Teacher Job Satisfaction scale and student achievement in mathematics, Australia and the international averages

Mathematics teachers' job satisfaction												
	Very satisfied				Somewhat satisfied				Less than satisfied			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	65	3.4	519	3.9	29	2.9	516	7.0	6	1.6	517	14.3
International average	61	0.5	503	0.6	34	0.4	499	0.9	5	0.2	515	2.1
Year 8												
Australia	45	3.4	529	5.6	46	3.5	515	6.0	9	1.9	492	12.1
International average	54	0.6	493	0.9	39	0.6	486	1.1	7	0.3	490	2.4

A4.7 The Mathematics Teacher Job Satisfaction scale, in Australia, by school socioeconomic composition

	Mathematics teachers' job satisfaction and school socioeconomic composition					
	Very satisfied		Somewhat satisfied		Less than satisfied	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	68	6.4	28	5.8	4	1.8
Neither more affluent nor more disadvantaged	63	5.5	31	5.3	6	3.0
More disadvantaged	58	7.4	35	7.5	7	3.5
Year 8						
More affluent	57	6.0	40	6.1	3	1.6
Neither more affluent nor more disadvantaged	42	5.4	40	5.7	19	5.1
More disadvantaged	32	6.0	59	5.8	9	3.4

A4.8 The Mathematics Teacher Job Satisfaction scale, in Australia, by school geographic location

	Mathematics teachers' job satisfaction and school geographic location					
	Very satisfied		Somewhat satisfied		Less than satisfied	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Major cities	67	4.0	28	3.5	5	1.8
Regional and remote areas	59	6.7	34	6.7	8	3.6
Year 8						
Major cities	47	4.5	47	4.5	6	1.9
Regional and remote areas	41	5.5	43	5.9	16	4.2

CHAPTER 5 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 5. Due to rounding, totals may not add to 100%.

A5.1 Percentages of students taught the TIMSS mathematics topics, Australia and the international averages

	TIMSS mathematics topics							
	All mathematics (17 topics)		Number (7 topics)		Measurement and geometry (7 topics)		Data (3 topics)	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	89	0.9	93	0.9	84	1.4	92	1.5
International average	80	0.1	86	0.1	76	0.2	78	0.3

	TIMSS mathematics topics									
	All mathematics (22 topics)		Number (3 topics)		Algebra (7 topics)		Geometry (6 topics)		Data and probability (6 topics)	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8										
Australia	72	1.2	97	0.7	60	1.5	72	1.3	72	2.1
International average	72	0.2	98	0.1	68	0.2	76	0.2	60	0.3

A5.2 The Instructional Clarity in Mathematics scale and student achievement in mathematics, Australia and the international averages

	Instructional clarity in mathematics lessons											
	High clarity of instruction				Moderate clarity of instruction				Low clarity of instruction			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	74	1.2	522	2.9	21	0.9	505	3.4	5	0.5	473	7.6
International average	74	0.2	508	0.5	21	0.1	488	0.7	5	0.1	466	1.2
Year 8												
Australia	40	1.5	540	4.3	42	1.0	511	3.8	18	1.3	487	4.4
International average	46	0.2	504	0.6	41	0.2	482	0.7	13	0.2	467	1.0

A5.3 The Instructional Clarity in Mathematics scale, in Australia, by school socioeconomic composition

	Instructional clarity in mathematics lessons and school socioeconomic composition					
	High clarity of instruction		Moderate clarity of instruction		Low clarity of instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	77	1.8	18	1.5	4	0.5
Neither more affluent nor more disadvantaged	71	2.5	22	1.6	7	1.2
More disadvantaged	75	1.8	20	1.4	5	0.8
Year 8						
More affluent	47	2.9	38	1.9	15	1.7
Neither more affluent nor more disadvantaged	35	2.0	44	1.5	21	1.7
More disadvantaged	36	2.7	46	1.7	18	2.5

A 5.4 The Disorderly Behaviour During Mathematics Lessons scale and student achievement in mathematics, Australia and the international averages

	Disorderly behaviour during mathematics lessons											
	Few or no lessons				Some lessons				Most lessons			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	7	0.8	542	6.4	76	0.9	522	2.6	17	1.1	479	5.5
International average	18	0.2	511	0.8	68	0.2	502	0.5	14	0.1	478	0.8
Year 8												
Australia	11	0.9	565	7.5	65	1.1	520	3.9	24	1.1	493	4.2
International average	21	0.2	502	0.9	65	0.2	485	0.6	13	0.2	466	1.0

A5.5 The Disorderly Behaviour During Mathematics Lessons scale, in Australia, by school socioeconomic composition

	Disorderly behaviour during mathematics lessons and school socioeconomic composition					
	Few or no lessons		Some lessons		Most lessons	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	7	1.4	79	1.9	13	2.1
Neither more affluent nor more disadvantaged	5	1.0	77	1.8	17	2.0
More disadvantaged	7	1.5	73	1.8	20	1.9
Year 8						
More affluent	16	2.0	68	2.0	16	1.8
Neither more affluent nor more disadvantaged	8	1.1	66	1.7	26	2.0
More disadvantaged	6	0.9	62	2.4	32	2.7

A5.6 The Mathematics Classroom Teaching Limited by Students Not Ready for Instruction scale and student achievement in mathematics, Australia and the international averages

Mathematics teaching limited by students not ready for instruction												
Very little				Some				A lot				
Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	
Year 4												
Australia	24	3.8	545	6.9	69	4.0	514	3.4	6	1.7	458	11.0
International average	36	0.4	517	0.9	59	0.5	495	0.6	6	0.2	476	2.2
Year 8												
Australia	27	2.8	580	8.5	64	2.9	502	3.2	9	2.1	449	9.0
International average	24	0.5	520	1.5	67	0.5	482	0.7	9	0.3	458	2.4

A5.7 The Mathematics Classroom Teaching Limited by Students Not Ready for Instruction scale, in Australia, by school socioeconomic composition

Mathematics teaching limited by students not ready for instruction and school socioeconomic composition							
		Very little		Some		A lot	
		Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4							
More affluent		32	6.9	68	6.9	0	0.1
Neither more affluent nor more disadvantaged		23	6.2	68	6.6	8	3.7
More disadvantaged		13	5.5	75	6.7	12	4.5
Year 8							
More affluent		39	4.9	60	4.9	2	1.4
Neither more affluent nor more disadvantaged		23	4.7	71	5.4	6	3.3
More disadvantaged		16	4.7	60	6.6	24	6.9

CHAPTER 6 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 6. Due to rounding, totals may not add to 100%.

A6.1 Percentages of students by the type of major of science teachers and student achievement in science, Australia and the international averages

Science teachers' formal education								
	Major in education* and science				Major in education but not science			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	22	3.5	535	6.6	73	3.5	534	3.0
International average	28	0.5	489	1.3	44	0.5	491	1.2
Year 8								
Australia	65	2.6	534	4.2	7	1.4	522	8.4
International average	33	0.5	494	1.3	9	0.3	482	3.2

Science teachers' formal education								
	Major in science but not education				All other majors			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	2	1.0	~	~	3	1.4	506	17.5
International average	13	0.3	480	2.5	9	0.3	478	2.4
Year 8								
Australia	19	2.4	540	6.5	9	1.7	512	8.8
International average	50	0.5	491	1.0	6	0.3	489	2.8

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'science education'.

~ Insufficient data to report achievement in this category.

A6.2 Percentages of students by the type of major of science teachers, in Australia, by school socioeconomic composition

	Science teachers' formal education and school socioeconomic composition							
	Major in education* and science		Major in education but not science		Major in science but not education		All other majors	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
More affluent	40	7.7	56	7.7	0	0.1	4	3.2
Neither more affluent nor more disadvantaged	11	3.5	81	4.8	4	2.8	3	2.5
More disadvantaged	18	5.4	78	5.7	2	1.4	1	1.2
Year 8								
More affluent	59	4.7	7	2.4	26	4.2	9	3.5
Neither more affluent nor more disadvantaged	75	4.5	5	1.7	16	4.0	4	1.8
More disadvantaged	59	6.9	9	3.9	17	5.4	14	4.7

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'science education'.

A6.3 Percentages of students by the type of major of science teachers, in Australia, by school geographic location

	Science teachers' formal education and school geographic location							
	Major in education* and science		Major in education but not science		Major in science but not education		All other majors	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Major cities	23	4.2	72	4.2	2	1.2	3	1.7
Regional and remote areas	21	6.2	74	6.3	3	1.7	2	1.4
Year 8								
Major cities	66	2.9	6	1.4	21	2.9	7	1.7
Regional and remote areas	59	5.4	11	3.7	15	4.1	16	5.3

* 'Education' at Year 4 refers to 'primary education' and at Year 8 it refers to 'science education'.

A6.4 Percentages of students by science teachers' areas of professional development, Australia and the international averages

	Science teachers' areas of professional development							
	Science content		Science pedagogy/ instruction		Science curriculum		Integrating technology into science instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	35	3.6	31	3.5	35	3.4	34	3.8
International average	35	0.4	33	0.4	34	0.4	32	0.4
Year 8								
Australia	50	3.5	54	3.5	62	2.9	49	3.1
International average	57	0.5	59	0.5	52	0.5	50	0.5

	Science teachers' areas of professional development							
	Improving students' critical thinking or inquiry skills		Science assessment		Addressing individual students' needs		Integrating science with other subjects	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	43	3.9	18	3.0	30	3.6	30	3.3
International average	36	0.5	28	0.0	33	0.5	31	0.5
Year 8								
Australia	55	3.6	44	3.0	66	2.8	–	–
International average	45	0.5	46	1.0	44	0.5	–	–

A6.5 Percentages of students by science teachers' needs for future professional development, Australia and the international averages

Science teachers' areas for future professional development								
	Science content		Science pedagogy/ instruction		Science curriculum		Integrating technology into science instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	54	3.9	59	3.7	54	3.7	74	3.3
International average	54	0.5	57	0.5	49	0.5	68	0.5
Year 8								
Australia	52	3.1	65	3.0	51	3.1	77	2.6
International average	52	0.5	60	0.5	51	0.5	70	0.5

Science teachers' areas for future professional development								
	Improving students' critical thinking or inquiry skills		Science assessment		Addressing individual students' needs		Integrating science with other subjects	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	68	4.0	66	4.0	61	4.4	67	3.7
International average	65	0.5	54	1.0	57	0.5	62	0.5
Year 8								
Australia	81	2.3	59	3.0	71	3.0	–	–
International average	68	0.5	58	1.0	66	0.5	–	–

A6.6 The Science Teacher Job Satisfaction scale and student achievement in science, Australia and the international averages

Science teachers' job satisfaction												
	Very satisfied				Somewhat satisfied				Less than satisfied			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	61	3.7	533	3.3	34	3.3	533	4.8	6	1.4	542	11.1
International average	61	0.5	493	0.6	34	0.5	490	1.0	5	0.2	508	2.2
Year 8												
Australia	55	3.0	535	4.2	34	3.0	531	6.3	11	2.0	520	8.9
International average	53	0.5	494	0.8	39	0.5	486	1.1	8	0.3	488	2.2

A6.7 The Science Teacher Job Satisfaction scale, in Australia, by school socioeconomic composition

	Science teachers' job satisfaction and school socioeconomic composition					
	Very satisfied		Somewhat satisfied		Less than satisfied	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	61	7.6	35	7.4	4	1.5
Neither more affluent nor more disadvantaged	59	5.7	33	5.5	7	3.2
More disadvantaged	53	7.5	42	7.6	6	3.2
Year 8						
More affluent	59	4.5	32	4.5	9	2.9
Neither more affluent nor more disadvantaged	53	5.3	34	4.4	13	3.7
More disadvantaged	51	6.7	39	5.7	10	4.0

A6.8 The Science Teacher Job Satisfaction scale, in Australia, by school geographic location

	Science teachers' job satisfaction and geographic location					
	Very satisfied		Somewhat satisfied		Less than satisfied	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Major cities	64	4.4	31	4.0	5	1.5
Regional and remote areas	51	6.6	41	6.7	8	3.4
Year 8						
Major cities	58	3.6	30	3.4	12	2.5
Regional and remote areas	46	6.6	48	6.4	7	2.3

CHAPTER 7 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 7. Due to rounding, totals may not add to 100%.

A7.1 Percentages of students taught the TIMSS science topics, Australia and the international averages

	TIMSS science topics							
	All science (26 topics)		Life science (7 topics)		Physical science (12 topics)		Earth science (7 topics)	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4								
Australia	65	1.6	70	1.9	63	2.0	65	2.1
International average	63	0.2	73	0.2	58	0.2	60	0.3

	TIMSS science topics									
	All science (26 topics)		Biology (7 topics)		Chemistry (8 topics)		Physics (7 topics)		Earth science (4 topics)	
	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8										
Australia	63	1.2	61	1.7	64	1.5	56	1.4	79	1.9
International average	72	0.2	74	0.2	74	0.2	68	0.2	71	0.3

A7.2 The Instructional Clarity in Science scale and student achievement in science, Australia and the international averages

	Instructional clarity in science lessons											
	High clarity of instruction				Moderate clarity of instruction				Low clarity of instruction			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	68	1.2	533	2.8	24	0.9	538	3.6	8	0.8	519	7.0
International average	72	0.2	498	0.5	22	0.1	480	0.8	6	0.1	466	1.3
Year 8												
Australia	41	1.4	548	3.4	40	0.8	523	3.5	18	1.3	507	5.2
International average	49	0.3	507	0.8	38	0.2	484	0.9	13	0.2	466	1.3

A7.3 The Instructional Clarity in Science scale, in Australia, by school socioeconomic composition

	Instructional clarity in science lessons and school socioeconomic composition					
	High clarity of instruction		Moderate clarity of instruction		Low clarity of instruction	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
More affluent	72	2.2	22	1.6	6	1.0
Neither more affluent nor more disadvantaged	64	2.1	28	1.4	9	1.3
More disadvantaged	67	2.4	23	1.8	10	2.4
Year 8						
More affluent	44	2.4	39	1.7	16	2.1
Neither more affluent nor more disadvantaged	41	2.0	40	1.7	19	2.2
More disadvantaged	38	2.4	42	1.5	20	2.3

A7.4 The Emphasis on Science Investigation scale and student achievement in science, Australia and the international averages

	Emphasis on scientific investigation							
	About half the lessons or more				Less than half the lessons			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	35	3.3	531	4.7	65	3.3	535	3.6
International average	31	0.4	491	1.1	69	0.4	490	0.7
Year 8								
Australia	14	2.3	542	10.8	86	2.3	532	3.8
International average	27	0.5	492	1.5	73	0.5	490	0.7

A7.5 The Emphasis on Science Investigation scale, in Australia, by school socioeconomic composition

	Emphasis on scientific investigation and school socioeconomic composition			
	About half the lessons or more		Less than half the lessons	
	Students (%)	SE	Students (%)	SE
Year 4				
More affluent	38	6.4	62	6.4
Neither more affluent nor more disadvantaged	32	6.6	68	6.6
More disadvantaged	33	8.3	67	8.3
Year 8				
More affluent	16	3.9	84	3.9
Neither more affluent nor more disadvantaged	17	4.7	83	4.7
More disadvantaged	9	4.3	91	4.3

A7.6 Frequency with which students conducted experiments in science lessons and student achievement in science, Australia and the international averages

Frequency of experiments in science lessons								
At least once a week					Once or twice a month			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	26	1.4	516	4.5	30	1.4	542	3.2
International average	31	0.2	475	0.7	26	0.2	499	0.7
Year 8								
Australia	39	1.6	534	4.1	42	1.2	541	3.6
International average	28	0.3	478	1.2	37	0.3	502	0.9

Frequency of experiments in science lessons								
A few times a year					Never			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4								
Australia	31	1.6	547	3.8	13	1.0	515	4.2
International average	24	0.2	503	0.8	18	0.2	478	0.9
Year 8								
Australia	14	1.0	516	3.8	5	0.7	443	10.1
International average	24	0.2	501	1.0	11	0.2	451	1.8

A7.7 Frequency with which students conduct experiments in science lessons, in Australia, by school socioeconomic composition

Frequency of experiments in science lessons and school socioeconomic composition									
At least once a week			Once or twice a month		A few times a year		Never		
Students (%)	SE		Students (%)	SE	Students (%)	SE	Students (%)	SE	
Year 4									
More affluent	22	3.3	35	2.5	32	3.1	11	1.8	
Neither more affluent nor more disadvantaged	27	2.6	29	2.0	30	2.3	14	1.3	
More disadvantaged	31	3.7	24	2.0	28	2.7	17	3.1	
Year 8									
More affluent	44	3.0	44	2.4	11	1.6	1	0.3	
Neither more affluent nor more disadvantaged	39	2.9	41	2.7	14	1.7	6	1.6	
More disadvantaged	36	3.6	38	2.5	17	2.2	9	1.6	

A7.8 The Science Classroom Teaching Limited by Students Not Ready for Instruction scale and student achievement in science, Australia and the international averages

Science teaching limited by students not ready for instruction												
Very little					Some				A lot			
Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	
Year 4												
Australia	26	3.8	559	5.0	69	4.0	528	3.1	6	1.6	481	10.4
International average	37	0.5	506	1.1	58	0.5	484	0.7	6	0.2	465	2.5
Year 8												
Australia	23	2.8	579	7.2	72	3.0	521	3.6	5	1.3	481	17.3
International average	26	0.5	515	1.3	66	0.5	484	0.7	8	0.3	457	2.7

A7.9 The Science Classroom Teaching Limited by Students Not Ready for Instruction scale, in Australia, by school socioeconomic composition

Science teaching limited by students not ready for instruction and school socioeconomic composition							
Very little				Some		A lot	
Students (%)	SE	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4							
More affluent	31	7.4	69	7.4	0	0.1	
Neither more affluent nor more disadvantaged	26	6.2	66	6.9	8	3.4	
More disadvantaged	15	5.7	75	6.6	10	4.2	
Year 8							
More affluent	38	5.4	61	5.2	1	0.8	
Neither more affluent nor more disadvantaged	17	3.1	79	3.9	4	2.3	
More disadvantaged	9	3.3	81	5.2	10	4.4	

CHAPTER 8 APPENDICES

The numbers of the appendix tables correspond to the figure numbers in Chapter 8. Due to rounding, totals may not add to 100%.

A8.1 The Students Like Learning Mathematics scale and student achievement in mathematics, Australia and the international averages

	Students like learning mathematics											
	Very much like learning mathematics				Somewhat like learning mathematics				Do not like learning mathematics			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	40	1.0	536	3.6	34	0.9	516	3.4	26	1.2	487	3.6
International average	45	0.2	520	0.5	35	0.1	491	0.6	20	0.1	479	0.7
Year 8												
Australia	13	0.7	576	5.1	37	0.8	536	4.5	50	1.2	489	3.4
International average	20	0.1	530	0.8	39	0.1	496	0.7	41	0.2	468	0.6

A8.2 The Students Like Learning Mathematics scale, in Australia (males and females)

	Students like learning mathematics (males and females)					
	Very much like learning mathematics		Somewhat like learning mathematics		Do not like learning mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Female	35	1.4	37	1.2	27	1.5
Male	44	1.4	30	1.3	25	1.2
Year 8						
Female	10	0.6	34	1.0	57	1.2
Male	17	1.1	39	1.1	44	1.6

A8.3 The Students Like Learning Mathematics scale, in Australia, by student socioeconomic background

	Students like learning mathematics and resources in the home					
	Very much like learning mathematics		Somewhat like learning mathematics		Do not like learning mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
A few books	40	1.8	31	1.3	29	1.9
Average number of books	39	1.2	36	1.2	25	1.3
Many books	42	2.4	33	2.5	26	2.2
Year 8						
Few resources	7	1.8	37	4.0	55	4.1
Some resources	12	0.7	35	0.9	53	1.3
Many resources	19	1.4	40	1.2	41	1.7

A8.4 The Students Like Learning Science scale and student achievement in science, Australia and the international averages

	Students like learning science											
	Very much like learning science				Somewhat like learning science				Do not like learning science			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	50	1.4	539	3.1	34	0.9	533	2.9	16	1.0	515	4.6
International average	52	0.2	506	0.5	36	0.1	478	0.6	12	0.1	467	0.9
Year 8												
Australia	27	1.1	569	4.1	45	0.8	526	3.5	28	1.3	499	3.6
International average	35	0.2	524	0.8	44	0.2	484	0.8	20	0.2	460	1.1

A8.5 The Students Like Learning Science scale, in Australia (males and females)

	Students like learning science (males and females)					
	Very much like learning science		Somewhat like learning science		Do not like learning science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Female	48	1.5	38	1.3	15	1.1
Male	52	1.6	31	1.0	18	1.2
Year 8						
Female	23	1.3	45	1.1	32	1.5
Male	31	1.7	45	1.3	24	1.5

A8.6 The Students Like Learning Science scale, in Australia, by student socioeconomic background

	Students like learning science and resources in the home					
	Very much like learning science		Somewhat like learning science		Do not like learning science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
A few books	48	1.8	34	1.5	18	1.4
Average number of books	49	1.5	35	1.2	16	1.1
Many books	54	3.1	32	2.0	14	1.7
Year 8						
Few resources	16	3.0	44	4.6	39	4.9
Some resources	24	1.1	46	0.8	30	1.4
Many resources	38	2.1	41	1.4	20	1.4

A8.7 The Students' Confidence in Mathematics scale and student achievement in mathematics, Australia and the international averages

	Students' self-confidence in mathematics											
	Very confident in mathematics				Somewhat confident in mathematics				Not confident in mathematics			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	29	0.8	568	3.4	46	0.8	513	3.2	25	0.9	465	3.2
International average	32	0.1	545	0.6	44	0.1	497	0.5	23	0.1	456	0.6
Year 8												
Australia	14	0.6	594	5.1	42	0.8	540	4.3	44	1.0	474	3.3
International average	15	0.1	562	0.8	42	0.1	502	0.6	44	0.2	456	0.6

A8.8 The Students' Confidence in Mathematics scale, in Australia (males and females)

	Students' self-confidence in mathematics (males and females)					
	Very confident in mathematics		Somewhat confident in mathematics		Not confident in mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Female	22	1.1	48	1.4	30	1.4
Male	35	1.1	44	1.2	20	1.1
Year 8						
Female	9	0.6	39	1.1	52	1.2
Male	18	1.0	46	1.0	36	1.4

A8.9 The Students' Confidence in Mathematics scale, in Australia, by student socioeconomic background

	Students' self-confidence in mathematics and resources in the home					
	Very confident in mathematics		Somewhat confident in mathematics		Not confident in mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
A few books	22	1.4	47	1.7	32	1.6
Average number of books	29	1.1	47	1.1	23	1.1
Many books	39	1.8	40	1.6	21	1.8
Year 8						
Few resources	4	1.1	33	3.6	62	3.6
Some resources	12	0.6	42	0.9	47	1.1
Many resources	20	1.3	46	1.4	34	1.6

A8.10 The Students' Confidence in Science scale and student achievement in science, Australia and the international averages

	Students' self-confidence in science											
	Very confident in science				Somewhat confident in science				Not confident in science			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 4												
Australia	32	1.1	553	3.0	47	0.9	532	2.8	21	0.9	508	4.1
International average	38	0.2	520	0.6	43	0.1	486	0.6	19	0.1	453	0.7
Year 8												
Australia	16	0.7	586	4.2	39	0.8	543	3.3	45	1.1	499	3.6
International average	23	0.2	547	0.9	39	0.2	500	0.8	38	0.2	456	0.9

A8.11 The Students' Confidence in Science scale, in Australia (males and females)

	Students' self-confidence in science (males and females)					
	Very confident in science		Somewhat confident in science		Not confident in science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
Female	32	1.6	47	1.4	21	1.3
Male	33	1.2	47	1.0	21	1.0
Year 8						
Female	13	0.7	37	1.0	50	1.3
Male	20	1.1	40	1.0	40	1.4

A8.12 The Students' Confidence in Science scale, in Australia, by student socioeconomic background

	Students' self-confidence in science and resources in the home					
	Very confident in science		Somewhat confident in science		Not confident in science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 4						
A few books	27	1.4	47	1.6	25	1.4
Average number of books	32	1.3	48	1.1	20	1.2
Many books	42	2.8	42	2.3	17	1.6
Year 8						
Few resources	6	1.7	28	3.7	66	4.0
Some resources	13	0.6	38	0.9	48	1.3
Many resources	27	1.7	41	1.4	32	1.7

A8.13 The Students Value Mathematics scale and student achievement in mathematics, Australia and the international averages

	Students' valuing mathematics											
	Strongly value mathematics				Somewhat value mathematics				Do not value mathematics			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 8												
Australia	38	0.9	539	4.5	48	0.8	514	3.8	14	0.6	479	4.8
International average	37	0.2	507	0.7	47	0.1	487	0.6	16	0.1	462	0.8

A8.14 The Students Value Mathematics scale, in Australia (males and females)

	Students' valuing mathematics (males and females)					
	Strongly value mathematics		Somewhat value mathematics		Do not value mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8						
Female	34	1.0	51	1.0	15	0.9
Male	42	1.2	45	1.0	13	0.8

A8.15 The Students Value Mathematics scale, in Australia, by student socioeconomic background

	Students' valuing mathematics by socioeconomic background					
	Strongly value mathematics		Somewhat value mathematics		Do not value mathematics	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8						
Few resources	24	2.9	54	4.0	22	3.7
Some resources	36	1.0	50	0.9	15	0.7
Many resources	47	1.7	43	1.4	10	0.9

A8.16 The Students Value Science scale and student achievement in science, Australia and the international averages

	Students' valuing science											
	Strongly value science				Somewhat value science				Do not value science			
	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE	Students (%)	SE	Average achievement	SE
Year 8												
Australia	28	0.9	561	4.1	42	0.6	530	3.5	29	0.8	501	3.1
International average	36	0.2	511	0.7	42	0.1	487	0.6	22	0.1	467	0.8

A8.17 The Students Value Science scale, in Australia (males and females)

	Students' valuing science (males and females)					
	Strongly value science		Somewhat value science		Do not value science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8						
Female	26	1.1	43	0.9	31	1.0
Male	31	1.1	42	0.9	27	1.2

A8.18 The Students Value Science scale, in Australia, by student socioeconomic background

	Students' valuing science by socioeconomic background					
	Strongly value science		Somewhat value science		Do not value science	
	Students (%)	SE	Students (%)	SE	Students (%)	SE
Year 8						
Few resources	15	2.4	46	3.9	39	3.8
Some resources	25	1.0	43	0.8	32	1.0
Many resources	41	1.5	41	1.2	18	1.1

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