OECD PISA

The PISA 2000 Survey of Students' Reading, Mathematical and Scientific Literacy Skills

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15-up and counting, reading, writing, reasoning ....

how literate are australia's students?

ACER OECD

Programme for International Student Assessment

Chapter **ONE**

INTRODUCTION

Australia has participated in most of the major surveys of educational achievement since the First International Mathematics Study in 1964, including the Third International Mathematics and Science Study in 1994-95 and its repeat in 1998-99. These studies have provided valuable information about our students' achievement of curriculum-related subject matter in comparison with the performance of students from a wide range of countries.

Most recently, over 6000 of our mid-secondary level students participated in a year 2000 international assessment of skills in areas considered essential for full participation in twenty-first century society. The assessment is known as the Programme for International Student Assessment (PISA). Internationally there were over a quarter of a million participants, including about 175 000 who undertook PISA as such and a further 85 000 who participated for special purposes within their own countries.

This Australian national report describes PISA and how it came about, provides details of Australia's participation, and presents and discusses Australia's results in both the national and international context. The report has been released at the same time as the main international report. Key information from the international report is incorporated here to enable the report to stand alone for Australian audiences.[1]

How PISA came about

PISA is part of an ongoing program of reporting on indicators in education undertaken by the Organisation for Economic Co-operation and Development (OECD) in Paris. The OECD has successfully developed indicators of human and monetary resources invested in education and in how

PISA – the Programme for International Student Assessment – is a new survey of students' skills, sponsored by the OECD.

[1] Readers interested in broader perspectives are referred to the international report and those with a particular interest in technical aspects of implementing such a major international study are referred to the Technical Report, which is due for publication early in 2002.

education and learning systems operate and evolve, and has reported on these for more than ten years through its annual publication *Education at a Glance*. What has been missing from the indicators is regular and reliable information on educational *outcomes* across countries, especially measures of skills. Without such measures it is difficult for a country to judge the effectiveness and comparative success of its education system(s).

To remedy this gap, the OECD, together with Statistics Canada, first developed and conducted a survey of adult literacy skills, the International Adult Literacy Survey (IALS). Australia was a participant in that study, which took place between 1994 and 1998. Secondly, the OECD and its member countries developed PISA to extend the measurement of outcomes to school-aged students. PISA has been designed and implemented to date by an international consortium led by the Australian Council for Educational Research (ACER), and the year 2000 assessment marked the beginning of what is planned to be a regular three-yearly assessment of skills for life among students nearing the end of their compulsory schooling. Reference to how the PISA assessment tasks were developed is made later in the chapter and a more detailed account of procedures is included in Appendix 1.

The consortium implementing PISA for the OECD is led by the Australian Council for Educational Research.

The survey, of skills in reading, mathematical and scientific literacy, will be carried out every three years in more than 30 countries. The first survey occurred in 2000.

PISA's main goals

In line with the OECD's aim to help the governments of its member countries formulate the best possible policies in all economic and social areas, PISA has the specific aim of providing reliable information on a regular basis to help enhance education programs and opportunities. Its primary focus is on public policy issues related to education provision within and across countries, such as:

- How well are young adults prepared to meet the challenges of the future? What skills do they possess that will facilitate their capacity to adapt to rapid societal change?
- Are some ways of organising schools and school learning more effective than others?
- What influence does the quality of school resources have on student outcomes?
- What educational structures and practices maximise the opportunities of students from disadvantaged backgrounds? How equitable is education provision for students from all backgrounds?

PISA hopes to contribute to the understanding of these and other similar policy-related questions through the development and use of internationally comparable measures administered with standardised procedures to those participating in the assessment. A primary goal is to construct and use measures in such a way that trends in student performance can be monitored validly over time.

PISA's overall focus is to assess how well students near the end of their compulsory schooling are prepared for meeting the challenges they will face in their lives beyond school.

What skills does PISA assess?

With its goal of measuring competencies that will equip students to participate productively and adaptively in their life beyond school education, PISA's assessment focuses on young people's ability to apply their knowledge and skills to real-life problems and situations. In such situations, are students able to analyse, reason and communicate their ideas effectively? How well do they make use of technological advances? Do they have the capacity and are they equipped with strategies to continue learning throughout their lives?

PISA's assessment tasks relate as far as possible to real-life problems and situations.

PISA uses the term 'literacy' to encompass this broad range of competencies relevant to coping with adult life in today's rapidly changing societies. In such a context, adults need to be literate in many domains, as well as in the traditional literacy areas of being able to read and write. The OECD considers that mathematics, science and technology are sufficiently pervasive in modern life that 'personal fulfilment, employment, and full participation in society increasingly require an adult population which is not only able to read and write, but also mathematically, scientifically and technologically literate' (OECD, 2000a, p. 9).

PISA applies the term 'literacy' to each of reading, mathematics and science to emphasise its focus on learning beyond the school curriculum.

Core domains

Following from the above, PISA has set the objective to assess competencies in each of the three core domains of reading literacy, mathematical literacy and scientific literacy, in detail for each domain every nine years but with more limited updates every three years. In 2000, PISA's major domain was reading literacy, to which almost 70 per cent of the assessment time was devoted. The remaining time in 2000 was allocated equally to mathematics and science as minor domains. In 2003 the focus will be on mathematical literacy, with limited measures of reading literacy and scientific literacy, and in 2006 the emphasis will be on scientific literacy, with the other two areas as minor domains.

The main assessment domain in PISA 2000 was reading literacy. In 2003 it will be mathematical literacy and in 2006 it will be scientific literacy.

The three core domains are outlined briefly below and are discussed in relation to student performance in Chapters 2, 3 and 4. The latter two chapters also contain some examples of reading, mathematics and science items used in the assessment.

Other domains

Consistent with its emphasis on skills useful for adult life, PISA intends progressively to introduce assessment of competencies that transcend the boundaries of school subjects. Relevant here are competencies in learning how to learn, competencies in self-concept and attitude development, skills in problem solving, and literacy in Information and Communication Technology. PISA 2000 included measures of 'self-regulated learning' (that is, strategies for managing and monitoring one's own learning), self-concept in relation to learning in academic areas, attitudes towards school, and self-assessed familiarity with and competency in

Students' attitudes to school and learning, and their familiarity with information technology, are among other variables assessed.

using computers. Problem-solving skills will be added to these cross-curricular areas for assessment in PISA 2003 (subject to a successful trial in 2002).

The cross-curricular competencies assessed in 2000 are discussed mostly in Chapters 6 and 8.

>> Who participates in PISA?

Countries

PISA began as a project of the OECD primarily for use in OECD member countries. At the time of the 2000 assessment, there were 29 member countries altogether, spanning most of Europe and also including the USA, Canada, Mexico, Japan, Korea, Australia and New Zealand. Only one OECD member country, Turkey, did not participate in PISA 2000, and Brazil, Latvia, Liechtenstein and the Russian Federation joined the project at their own request. Thus, 32 countries took part in the year 2000 assessment. A further 13 countries will do the same assessment early in 2002. The OECD now has a thirtieth member, Slovakia, which, as well as Turkey, will be participating in PISA 2003. PISA's coverage of countries is illustrated in Figure 1.1.

Most OECD countries took part in PISA in 2000 and all will participate in 2003. Other countries participate at their own request. Altogether, more than 40 countries are expected to take part in 2003.

Schools

From each country, a sample of 150 or more schools was randomly chosen to participate, except in small countries that have a smaller number of eligible schools. Any school, college or other type of educational institution with 15-year-old students enrolled was eligible for selection. In most countries schools were drawn with probability proportional to their enrolment of eligible students, meaning that larger schools had a greater chance than smaller schools of being selected. The 231 Australian schools that participated in PISA 2000 came from all parts of the country. Aspects of the composition of the Australian sample are shown in Chapters 2 and 5, and a more detailed discussion of the sampling procedures can be found in Appendix 2.

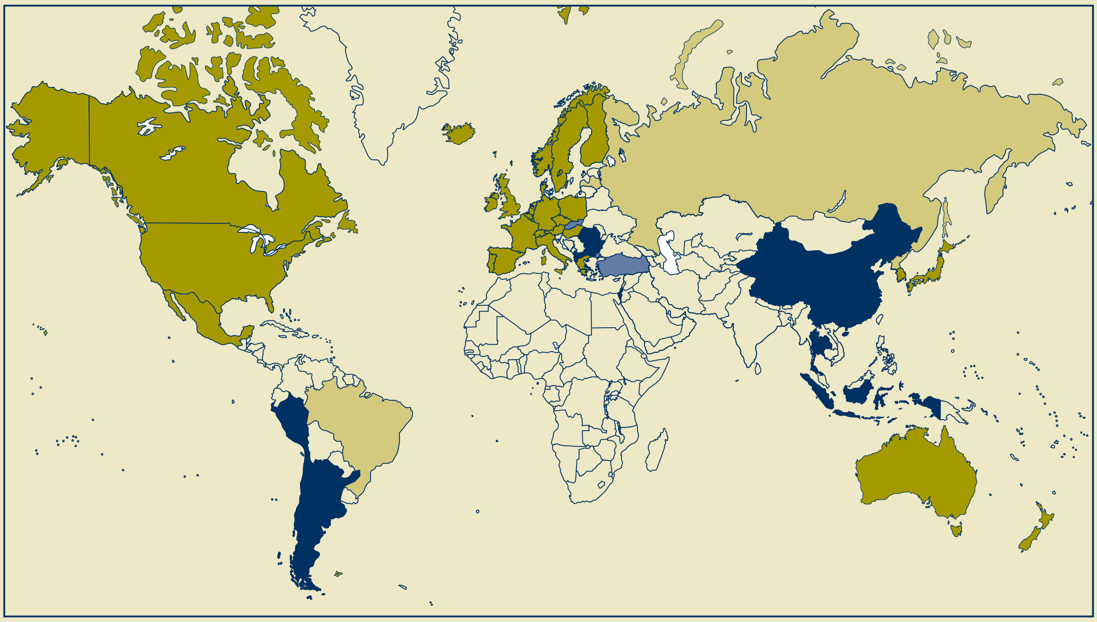
Minimum sample sizes are specified internationally. In 2000, 231 Australian schools, from all regions of the country, took part.

Students

The target population for PISA is nominally students who are aged 15 years and enrolled in an educational institution, either full- or part-time, at the time of testing. An age-based population was chosen because it is not possible internationally to define comparable populations in terms of a grade level. This comes about because differences among countries in the nature and extent of pre-primary education and the age of entry to formal schooling are widespread. Members of the PISA student sample are randomly selected on an individual basis from lists of age-eligible students, regardless of grade level, provided by their schools. The desired number of students to be selected from each school for PISA 2000 was specified internationally as 35.

The students assessed are mostly 15 years of age. They are enrolled either full-time or part-time in an educational institution.

Countries participating in PISA



OECD countries

- Australia
- Austria
- Belgium
- Canada
- Czech Republic
- Denmark
- Finland
- France
- Germany
- Greece
- Hungary
- Iceland
- Ireland
- Italy
- Japan
- Korea
- Luxembourg
- Mexico
- Netherlands
- New Zealand
- Norway
- Poland
- Portugal
- Spain
- Sweden
- Switzerland
- United Kingdom
- United States

Non-OECD countries

- Brazil
- Latvia
- Liechtenstein
- Russian Federation

Countries where the assessment will be completed in 2002

- Albania
- Argentina
- Bulgaria
- Chile
- China
- Special Administrative Region of Hong Kong
- Indonesia
- Israel
- Macedonia
- Peru
- Romania
- Thailand

OECD countries participating in PISA from 2003 onwards

- Slovak Republic
- Turkey

Figure 1.1 Countries Participating in PISA

For ease of implementation in Northern Hemisphere countries, where the assessment was mostly carried out between March and May, the target population for PISA 2000 was specified operationally as students who were born in 1984. Thus, typically in Northern Hemisphere countries the target students were aged between

15 years 3 months and 16 years 2 months. In Southern Hemisphere countries, where the assessment was carried out at a comparable stage of the school year as in the Northern Hemisphere, the birth date period for eligibility had to be adjusted so that the same age range of 15 years 3 months to 16 years 2 months would apply. Although, strictly speaking, some of the PISA students in all countries were aged 16 at the time of the assessment, for convenience they are referred to in most parts of this report (and in the international report) as being 15 years old.

In Australia, where the assessment was carried out in July-August, the target population was defined as students born between 1 May 1984 and 30 April 1985 to achieve the desired age range. Further details of the Australian student sample are provided in Chapters 2 and 5, and also in Appendix 2.

The first PISA survey took place in Australia in July and August of 2000.

What did PISA 2000 participants need to do?

Most countries set up a PISA National Centre to implement the project in their country[2], following procedures developed by the PISA International Project Centre at ACER in Melbourne. Participating schools had to assist their national centre by nominating a School Coordinator to help with the logistics of arranging assessment sessions, to provide lists of eligible students and to assist with the assessment session itself. In the majority of countries, including Australia, external testers administered the actual assessment sessions (see Appendix 1). The principal (or designate) in each participating school completed a 30-minute questionnaire, referred to in some detail in Chapters 6 and 8 of this report.

Participating students each responded to a two-hour assessment booklet and a 30- to 40-minute questionnaire. All assessment booklets contained reading items. Internationally, there were nine regular assessment booklets altogether, five of which contained some mathematics items and five of which contained some science items. Two booklets contained items from all three areas. A special, easier booklet was prepared for use in countries where more than two or three per cent of the student cohort were segregated in special education schools. The assessment took the form of written tasks, a few requiring extended written answers, some requiring paragraph-length answers, some needing short answers such as a word or phrase, and some presented in multiple choice format. The nine regular assessment booklets were assembled according to a complex design so that each booklet was linked through common items to other booklets in a balanced way. The booklets were distributed in strict rotation to students around the assessment room.

Each student answered a two-hour assessment booklet and a 30-minute questionnaire. Principals also answered a questionnaire about their schools.

In Australia, as a national option, a tenth booklet, containing 30 minutes each of PISA units in mathematics and science and 30 minutes each of mathematics and science items from the Third International Mathematics and Science Study (TIMSS), was introduced into the rotation. Providing a link between PISA and TIMSS in this way is of particular interest in Australia, where the cohort of students assessed in PISA is largely the same cohort tested as nine-year-olds in TIMSS in 1994 and as 13-year-olds in the repeat of TIMSS in 1998. Results from this

[2] The national centre for PISA 2000 was the Australian Council for Educational Research (ACER).

PISA-TIMSS link are not included in this first Australian PISA report, but will be the subject of a separate smaller report in 2002.

Nine booklets were necessary internationally to achieve the desired extent of coverage of material. Altogether, about seven hours of assessment items were distributed throughout the nine booklets, one hour each of mathematics and science and the remainder, reading. Items were rarely presented singly. Usually from two to five items were related to a theme, requiring reading of context setting stimulus material, even in mathematics and science (see Chapters 3 and 4 for illustrative items). Key elements of the assessment frameworks, which the tests were developed to assess, are outlined in the next section.

As a priority for PISA 2000, the Student Questionnaire collected detailed information on the students' home backgrounds. A range of other information was also collected, for example, on their attitudes and plans. All students responded to the core questionnaire, which was about 30 minutes long. Assessment of the cross-curricular competencies of self-regulated learning and familiarity with computers was offered internationally in 2000 on an optional basis, through modules added to the Student Questionnaire and requiring an extra 10 to 15 minutes of students' time. Australia chose to take part in both of these international options, along with 24 other countries for self-regulated learning and 19 other countries for computer familiarity. The scope and content of the questionnaires are described in Chapter 6.

Student questionnaires collected information on the students' background and activities, on their school-related attitudes and on some of their school experiences.

International achievement studies, particularly those (such as TIMSS) conducted under the auspices of the International Association for the Evaluation of Educational Achievement (IEA), typically include one or more questionnaires for teachers as well as the questionnaires for principals and students. A decision was made early in the project not to have a teacher questionnaire in PISA 2000. This decision was taken because students were sampled individually in PISA, not in class groups. Even in moderate-sized schools it would have been difficult to determine which teachers would be the most appropriate to respond to a questionnaire. Further, it would have been more difficult than usual to obtain a good response rate and to identify teacher effects on achievement.

>> *The core assessment domains*

Decisions about the scope and content of PISA's assessment domains have been made jointly by countries participating in the project, through a Board of Participating Countries (BPC) set up by the OECD. All participating OECD countries have representation, at senior policy levels, on this Board and other countries have observer status. Working groups of leading international experts in the three core domains met on several occasions to develop the assessment framework in consultation with the consortium running the study and OECD personnel. Members of these expert groups came from a wide range of OECD countries. As the development progressed, several versions of the draft framework were considered by the BPC.

An Assessment Framework in reading, mathematical and scientific literacy was prepared specially for PISA by international experts. The Framework defined what needed to be covered in the assessment instruments.

The framework was eventually published as an internationally agreed document in *Measuring Student Knowledge and Skills: A New Framework for Assessment* (OECD, 1999). Following some general comments about PISA's 'literacy' approach, a summary of key elements of the framework is given here.

In its connotation as possessing knowledge and skills for adult life, being literate in PISA terms means being able to reflect on and use knowledge and experience flexibly in a range of situations, as well as being familiar with and understanding basic concepts. Literacy in this sense is acquired partly through the school curriculum, but also through social interactions outside school and through other extra-curricular influences. The acquisition of literacy in this broader sense is a life-long process, not a process that occurs only during one's school years. Literacy skills develop along a continuum, not as something that individuals either have or do not have – though for some contexts or purposes, such as Australia's national literacy benchmarks (Department of Education, Training and Youth Affairs, 1998), it may be appropriate to set minimum acceptable levels.

Each PISA domain is described in terms of three main facets:

- knowledge of important concepts that students need to acquire (for example, familiarity with gravitational forces or with various forms of written text);
- processes that students need to undertake in applying their knowledge to particular problems (for example, locating and understanding relevant information in a text); and
- the contexts in which their knowledge and skills need to be applied.

The literacy areas assessed are defined in terms of content, processes and contexts.

Reading literacy

In PISA, reading literacy is defined as:

> *the ability to understand, use and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate effectively in society.*

Reading is thus much more than decoding written words and literally comprehending them. It includes understanding texts at a general level, interpreting them, reflecting on their content and form in relation to the reader's own knowledge of the world, and arguing a point of view in relation to what has been read. The definition incorporates PISA's emphasis on acquiring skills that will be relevant throughout life.

PISA's concept of reading literacy emphasises skills that will be relevant throughout life.

The main dimensions of reading literacy included in the PISA assessment framework are the type of reading task (whether the task primarily requires retrieving information, interpreting what has been read, or reflecting on what has been read); the form of the text (whether the text is continuous, as in a narrative, or non-continuous, as in a list or diagram); and the use for which the text was constructed (whether it is intended for private, educational, occupational, or public awareness purposes).

Mathematical literacy

Mathematical literacy is defined as:

> *the capacity to identify, understand and engage in mathematics, and to make well-founded judgements about the role that mathematics plays in an individual's current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen.*

Thus, mathematical literacy revolves around wider uses of mathematics in people's lives than being able to carry out mechanical operations with numbers and symbols. It indicates the ability to put mathematical knowledge and skills to functional use as well as the ability to pose and solve mathematical problems in a variety of situations and having the interest and motivation to do so.

Mathematical literacy emphasises the ability to formulate and solve mathematical problems in situations encountered in real life.

The assessment framework for mathematical literacy in PISA 2000 features three broad dimensions: mathematical content; mathematical processes; and the situations in which mathematics is used. Content is specified in terms of broad mathematical concepts and underlying mathematical thinking. For 2000, when mathematics was a minor domain, the broad concepts were restricted to two major areas: 'change and growth' and 'space and shape'. These areas were chosen because they are broad enough to allow a wide coverage of curriculum strands such as algebra, geometry, measurement, probability, functions and relations, and data representation and analysis. Other major areas, for example, quantitative reasoning, will be added in PISA 2003 when mathematics is the major assessment domain.

In the framework, mathematical processes are organised into three main classes, according to the skill or competency required to complete a task. One class consists of routine computations or definitions, which are often an important part of school mathematics assessments; another consists of making connections and using reasoning to solve relatively straightforward problems; and the third involves more complex mathematical thinking, analytical reasoning and insight. The situations in which the PISA mathematics tasks are set are classified as private/personal, school life, work and sports, community/society, and scientific. The tasks attempt to represent the kinds of problems that people encounter in real life.

Scientific literacy

PISA defines scientific literacy as:

> *the capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity.*

As such, it relates to the ability to think scientifically in a world in which science and technology are increasingly shaping our lives. It is considered a key outcome of education for all students by the end of schooling, not just for future scientists, given the growing centrality of science and technology in modern societies. The important skill is to be able to think scientifically about evidence and the absence of evidence for claims that are made in the media and elsewhere, as part of daily life.

Scientific literacy emphasises an understanding of the nature of science as well as an understanding of certain key scientific concepts.

The three dimensions of scientific literacy in the PISA assessment framework are scientific concepts; scientific processes; and scientific situations and areas of application. There are some basic concepts that students need to understand in order to make sense of the world around them and how human activity should be managed in order not to have a negative impact on the environment. PISA's science assessment tasks relate to everyday contexts rather than to laboratory situations. The contexts relate to life in general, some from a public awareness and global perspective and some from more personal concerns.

The science assessment tasks draw on concepts from the traditional areas of physics, chemistry, biological sciences and Earth and space science, bringing these together in the overarching areas of science in life and health, science in technology and science in Earth and environment. Within the overarching areas, tasks are grouped in themes such as physiological change, forces and movement, and biodiversity. Scientific processes required by the PISA science tasks include demonstrating understanding of basic scientific concepts; recognising questions that can be answered by scientific methods; identifying evidence needed in an investigation; drawing appropriate conclusions; and communicating conclusions to others.

>> *Skills for life?*

Without follow-up of future educational and occupational outcomes of the students assessed in PISA it is not yet possible to say how relevant their skills at age 15 will be in later life. However there is evidence from both the International Adult Literacy Survey (IALS) and the Longitudinal Surveys of Australian Youth (LSAY) of differential future educational success and labour market experiences of people with higher and lower achievement in literacy. The IALS established that people with higher levels of literacy were more likely than those with lower levels to be employed and have higher average salaries. People placed in the lowest two of five defined IALS levels of literacy skills were at least twice as likely to be unemployed as those placed in the top three levels (OECD, 2000b). Further, the IALS was able to show that literacy levels predicted how well people did in the labour market over and above what could be predicted from their educational qualifications alone.

Past research has clearly shown that people with higher levels of literacy and numeracy skills during their school years make better progress in the labour market as adults.

Follow-up studies of several cohorts of secondary students in LSAY have shown the consistent picture that those who have acquired sound mastery of literacy and numeracy skills by Year 9 are more likely to go to university, to find jobs and to earn higher incomes. The converse also tends to be true, in that those who do not demonstrate mastery of these key skills by Year 9 rarely get into university, are more likely to experience unemployment and remain in lower paid jobs if they do manage to obtain employment (Lamb, 1997). Further, LSAY has shown that 'the effects of school achievement (in literacy and numeracy) on both the incidence and duration of unemployment remains until at least the age of 30 even when controlling for post-school qualifications' (Marks & Fleming, 1998).

There is also evidence from LSAY that psychological variables such as engagement in school life (assumed to reflect positive attitudes towards school) and self-concept of academic ability measured in Year 9 both contribute significantly, over and above socio-demographic factors, to whether students complete their secondary schooling (Marks, Fleming, Long & McMillan, 2000). This evidence lends support to PISA's inclusion of items on a range of psychological constructs in the Student Questionnaire, as discussed in Chapter 6.

>> *Development of the PISA assessment tasks*

As with the assessment framework, development of PISA's assessment tasks was a collaborative effort between all participating countries, guided and monitored by the BPC. Countries submitted stimulus material and items for consideration that were typical of assessment materials used in their country. The materials submitted were reviewed by the subject matter expert groups and by assessment specialists, and further items were developed as needed to ensure adequate coverage of each component of the framework. All items were rated by participating countries for cultural appropriateness, interest to 15-year-olds, curricular and extra-curricular relevance, and appropriate difficulty level.

The instruments used in PISA were developed collaboratively. Many countries contributed materials and ideas.

The instruments were developed in both English and French. Countries with languages other than English or French were required to prepare two translations, one from the English version and one from the French, to reconcile the two translations and then submit the reconciled version to the consortium for verification. Every effort was made to ensure the linguistic equivalence of the tests in all countries.

>> *How results are reported*

While it is always interesting to look at comparative achievement in international studies, it is well recognised that comparative results gain meaning only when considered in relation to the educational contexts in which they occur. PISA results are reported in several ways, with reporting of means and distributions of achievement supplemented by consideration of many other variables. An innovative feature in PISA is its focus on 'described proficiency scales' to attach meaning to the achievement results. These scales describe achievement in terms of skills that students with increasing levels of proficiency are able to demonstrate.

A special feature of PISA is the way that reading literacy results are reported in terms of descriptions of students' skills at five levels of proficiency.

For the major domain of reading, five levels of proficiency are defined and described for reading overall and for three aspects of reading: retrieving information; interpreting texts; and reflecting on and evaluating texts. For the minor domains, where there were few assessment tasks on which to base descriptions of proficiency, only high, medium and low levels of proficiency, with no clearly defined boundaries, are described. Further details of the proficiency scales, including countries' results in relation to the scales, are contained in Chapter 3 for reading literacy and Chapter 4 for mathematical and scientific literacy.

PISA and TIMSS

While PISA and TIMSS are both international surveys of student achievement that share some methodological features, they differ in important ways. Firstly, the surveys are aimed at different student cohorts, namely 15-year-olds in PISA and eighth grade students (mostly aged 14) in TIMSS. TIMSS also assesses a primary-school-aged cohort. Secondly, PISA assesses a wider range of outcomes than does TIMSS. Most importantly, the two surveys differ in the nature of their assessment instruments. In TIMSS, the assessment items were prepared following a detailed analysis of curriculum documents and textbooks in each participating country, to ensure coverage of core topics that were common across countries. In PISA, as described in this chapter, the focus of the assessment materials is much more on broad skills and competencies considered to be crucial to full participation in society beyond school. TIMSS is a curriculum-based assessment, while PISA goes beyond the curriculum to assess a wider and more general range of skills.

PISA differs from the earlier TIMSS survey in several respects.

How PISA can inform policy in Australia

PISA provides a comprehensive assessment of the yield of education systems, to some extent with reference to school curricula but to a larger extent in relation to more generalised skills for life and preparedness for life-long learning. Many procedures are used to ensure that the PISA instruments are internationally comparable and reliable and that the data are collected and processed in standardised ways (see Appendix 1). The procedures and the rigour with which they have been applied in PISA 2000 ensure that the data will serve as a baseline profile of the knowledge, skills and competencies of students near the end of their compulsory schooling, in key domains of learning.

PISA measures are developed to very high quality standards and can be trusted to provide reliable data.

Population estimates derived from PISA for 15-year-olds (the majority of whom are in Year 10) will be able to contribute to national reporting of the achievement of set standards, in a similar way to the current reporting for younger age groups of percentages achieving national literacy and numeracy benchmarks. PISA will enhance that reporting through having high quality measures of achievement in science as well as in mathematics and in aspects of reading literacy. Even in the minor domains, PISA's measures are sufficiently reliable to justify reporting in this way. Later PISA cycles will enable changes and trends – in the achievement of standards, in the distributions of students' proficiency levels and in factors related to achievement – to be monitored over time.

Monitoring of changes and trends in performance over time are among PISA's objectives as further surveys are carried out.

In addition, PISA uses described proficiency scales to attach meaning to the scores obtained on the performance measures. It is relevant for those who determine policy in education to be informed about the kinds and levels of life-skills possessed by students at age 15, at an important stage in the students' preparation for the future. The comparative results enable Australian educators to evaluate the success of Australian schools and school programs in helping students to become literate citizens, relative to schools and programs in other countries. The sampling design used within Australia also allows comparisons to be made between the states' and territories' results and allows the states and territories to assess their students' performance in relation to the OECD as a whole as well as to individual countries.

Through the Australian PISA results, education managers can identify areas of strength and weakness in our students' competencies, and, in relation to other countries' results, can assess the extent to which the strengths and weaknesses are similar to or different from those identified elsewhere. Such analyses could have implications for program content and resource allocation.

Through the detailed reporting in PISA of students' skills, education policy makers are informed of relative strengths and weaknesses and can assess the adequacy of their countries' education programs.

The information collected in the PISA questionnaires allows comprehensive analyses of the demographic, social, economic and educational factors related to student and school performance. Differences in achievement patterns within Australia, including the extent to which schools appear to influence the relationship between achievement and the economic, social and cultural capital of students' families, can be studied. Schools which have succeeded in having their students achieve high results regardless of the students' home backgrounds may serve as models for improving equity in the education system. The analyses by country of achievement level together with the relationship between home background and achievement can serve as benchmarks against which Australia can judge its effectiveness in reducing inequalities in education.

PISA also provides insight into what contributes to students' learning outcomes and can indicate where schools and countries are succeeding in reducing inequalities in education.

Finally, PISA data can offer insights into whether or how characteristics of schools and deployment of resources are associated with students' proficiency levels, and may point to changes in practice that could be worth considering in relation to improving students' performance overall.

The issues mentioned here are each addressed in various parts of the report and are revisited in the final chapter.

>> *Organisation of the report*

The second, third and fourth chapters present and discuss Australia's results in relation to other countries' results, firstly in terms of the means and distributions of performance in each domain (Chapter 2) and secondly in terms of the described proficiency scales (Chapters 3 and 4). Further information on the nature and coverage of the assessment tasks accompanies the discussion of the proficiency scales. Facets of the assessment frameworks are illustrated with a selection of the PISA items that have been released for general use and some comparative results on the illustrated items are included.

Chapter 5 focuses on results for the Australian states and territories and for other sub-national groups. Results achieved by Indigenous students and by students with language backgrounds other than English are included in this chapter. The sixth chapter describes the Australian PISA participants in some detail, presenting a profile of the Australian schools and students who took part in the study. The relationships with achievement of a range of school and student characteristics considered one at a time are also examined.

Some of the most powerful findings are presented in Chapters 7 and 8. Chapter 7 contains the results of analyses of social background factors in relation to achievement country by country, drawing attention to some implications for policy. Multilevel analyses of school and student factors related to achievement in Australia are presented and discussed in Chapter 8, with findings from other countries referred to where of interest. Chapter 9 takes up issues that arose from other chapters and warranted further discussion. For example, the chapter contains an analysis of the characteristics of the highest and lowest achieving Australian students. Chapter 10, the final chapter, contains a summary of the implementation and results of PISA 2000 in Australia, followed by a summary of policy considerations arising from the results.

Chapter **TWO**

AUSTRALIA'S RESULTS IN INTERNATIONAL PERSPECTIVE

In this chapter, the international PISA results are shown in terms of means and distributions of achievement by country, presented and discussed from an Australian viewpoint. Results are included for each of reading, mathematical and scientific literacy. Within reading literacy, results are shown for the three reading process dimensions of 'retrieving information', 'interpreting texts' and 'reflecting on and evaluating texts'. Summary results only are presented in this chapter. The nature of the process dimensions is described in the next chapter, where some sample assessment items are also included.

Although there are several process dimensions in the PISA mathematics and science assessment frameworks just as there are in the reading framework, mathematical literacy and scientific literacy are minor domains in PISA 2000. There were too few mathematics and science items included in the test for sub-scales in these areas to be developed. Mathematics will be analysed in more detail following the 2003 assessment, in which it is the major domain, and science likewise following the 2006 assessment.

PISA results in the form of means and distributions are informative for those whose main interest is in the question of how well a country is doing relative to other countries in equipping its students, by the time they reach 15 years of age, with skills that are likely to be very important to them in their future lives. Summary statistics such as means and distributions say very little about the nature and range of skills the students have demonstrated, however. To add meaning and depth to the results behind the summary statistics featured in the present chapter, the analytical procedures used in PISA have enabled rich descriptions to be made of the skill profiles of students throughout the distributions, both within and across countries. These described skill profiles, which are the subject of Chapters 3 and 4, should be of particular interest to teachers, principals and other professional educators.

This chapter focuses on comparisons of means and distributions of scores. Descriptions of skills associated with different score levels are in Chapters 3 and 4.

A key element of PISA in Australia is the opportunity it provides to examine performance at state and territory level, including descriptions of proficiency levels achieved as well as in terms of summary statistics such as means and standard deviations. Both kinds of results are presented and discussed in Chapter 5 for various subsets of students of interest within Australia, but particularly for the states and territories.

Results for the Australian states and territories are in Chapter 5.

Achieved samples

All countries

The number of students assessed in each country's PISA sample is shown in Table 2.1, together with the estimated number of students of PISA-eligible age enrolled in an educational institution within the country. The 32 countries listed comprise all but one (Turkey) of the OECD member countries at the time the study began in 1998, plus four non-OECD countries (Brazil, Latvia, Liechtenstein and the Russian Federation).

Table 2.1 Number of Students in PISA Sample and Population, by Country

Country	Sample N	Population N	Country	Sample N	Population N
Australia	5 176	229 152	Korea	4 982	579 109
Austria	4 745	71 547	Latvia*	3 920	30 063
Belgium	6 670	110 095	Liechtenstein*	314	325
Brazil*	4 893	3 402 280	Luxembourg	3 528	4 138
Canada	29 687	348 481	Mexico	4 600	960 011
Czech Republic	5 365	125 639	The Netherlands	2 503	157 327
Denmark	4 235	47 786	New Zealand	3 667	46 757
Finland	4 864	62 826	Norway	4 147	49 579
France	4 673	730 494	Poland	3 654	542 005
Germany	5 073	826 816	Portugal	4 585	99 998
Greece	3 644	111 363	Russian Federation*	6 701	1 968 131
Hungary	4 887	107 460	Spain	6 214	399 055
Iceland	3 372	3 869	Sweden	4 416	94 338
Ireland	3 854	56 209	Switzerland	6 100	72 010
Italy	4 984	510 792	United Kingdom	9 340	643 041
Japan	5 256	1 446 596	United States	3 846	3 121 874
			TOTAL	**173 895**	**15 959 166**

* Not an OECD country

Internationally, the desired minimum number of students to be assessed per country was specified as 4500. Some countries, including Australia, sampled more students so that language groups or regions within the country could be adequately represented. In the small countries of Iceland, Liechtenstein and Luxembourg, the whole cohort of age-eligible students was assessed.

Australia

The main sample of 5176 Australian students whose results are featured in this report (and in the international report) came from 231 schools throughout the states, territories and sectors according to the distributions shown in Table 2.2. A further 700 or so Australian students were selected as part of the main regular sample, but were given a special assessment booklet rather than one of the nine PISA booklets. The special booklet, which contained both PISA items and TIMSS items, was designed specifically to provide a link between these two studies. Results for this component of PISA in Australia are not included in this report or in the international report – rather, they will be featured in a supplementary Australian report to be released early in 2002. Additional Indigenous students were also sampled, for whom results are given in Chapter 5 of this report.

5176 Australian students from 231 schools took part in the main PISA survey.

The participating Australian schools and students are described in Chapter 6 and further details of the PISA sampling design, procedures and response rates are provided in Appendix 2.

Table 2.2 Australian PISA Schools and Students by State/Territory and Sector

Sector	NSW	VIC	QLD	SA	WA	TAS	NT	ACT	TOTAL
Government									
N schools*	26	20	23	19	19	18	11	16	152
N students*	593	460	511	382	373	417	195	343	3274
Weighted N#	49 684	32 318	26 332	10 946	14 869	4584	1203	2202	142 138
Catholic									
N schools	9	8	6	5	5	3	3	4	43
N students	203	188	138	130	125	67	70	100	1021
Weighted N	16 450	15 715	8360	3202	4263	821	221	1546	50 578
Independent									
N schools	5	6	6	5	5	3	3	3	36
N students	123	157	156	113	110	77	68	77	881
Weighted N	10 728	9285	6672	3208	4862	847	240	594	36 436
TOTALS									
N schools	40	34	35	29	29	24	17	23	231
N students	919	805	805	625	608	561	333	520	5176
Weighted N	76 862	57 318	41 364	17 356	23 994	6252	1664	4342	229 152

* Achieved sample
\# Number of students in target population represented by sample

In terms of response rates, most countries achieved coverage of at least 95 per cent of the students who were enrolled in an educational institution, the specified international criterion to ensure comparability of results. The detailed international response and coverage rates can be seen in Table A2.4 in Appendix 2.

Students could be excluded from the assessment for reasons of remoteness, severe disability or unfamiliarity with the language of the test because they were recent arrivals in the country, up to a maximum exclusion rate of 5 per cent of the cohort. Many countries, including Australia, achieved at least 97.5 per cent coverage, as can also be seen from Table A2.4.

Even within these levels of coverage, however, a difference of two to three per cent could have an impact on countries' average scores, and it is therefore useful to keep the achieved exclusion rates in mind when considering results. In the achievement charts featured in this chapter, for example, countries are listed in order of the best estimate of their mean score, and sometimes the actual mean scores are less than 0.1 (in about 500) apart. In this context, a difference in exclusion rate from under 2.5 per cent, as achieved in Australia, to about 5 per cent, as was the case in Canada, New Zealand, and the United Kingdom, could easily change the order in which countries are listed.

The Netherlands participated in the assessment but was unable to obtain a sufficiently high response rate of its sampled schools to meet the international criteria for full inclusion of its results in the international report. For this reason The Netherlands is omitted from the comparative achievement charts in this chapter.

>> *International achievement charts*

Summaries of achievement by country are displayed graphically in the next three sections of the chapter. Overall achievement in each of PISA's three main literacy domains is presented in three charts, one per domain, while performance in the three components of reading literacy is shown in a further three charts.

Bar charts

The charts each contain a series of coloured bars and use these to display:
- the mean (average) score in a domain for each country;
- an indication of how much reliance can be placed on the mean score as an accurate estimate of the population result (the accuracy of the estimate provided by the mean score varies according to sample size and to how the sampling was done);
- the range of achievement by country for the middle half of each distribution;
- the range of achievement by country for all but the lowest and highest five per cent of students in each case;
- a visual picture of countries placed in order of increasing mean performance from left to right.

As is typical in large-scale international achievement studies, the results on each of the tests reveal substantial differences both in mean achievement between the highest and lowest performing countries and also in the spread of scores *within* countries.

Metric for reporting summary results

Item response theory (IRT) methods have been used in PISA to create reporting scales in each domain and in each sub-domain of reading literacy. Internationally, the overall reading literacy scale was constructed to have a mean of 500 points and a standard deviation of 100 points across the participating OECD countries. The choice of these values means that about two-thirds of the students across countries have scored between 400 and 600 points. In constructing the scale, countries' results were weighted so that they contributed equally to it, regardless of sample size or population size. The means and standard deviations of the three reading literacy sub-scales vary slightly from 500 and 100, respectively, because the scales were constructed with reference to the overall scale, not as separate scales.

Special reporting scales were constructed for PISA, each with a mean of 500 and a standard deviation of 100.

Each of the means mentioned in the above paragraph is referred to by the OECD as a 'country average' and can be used appropriately to compare a country's performance with the performance of a 'typical' OECD country on the same indicator.[1] In the Australian report the term 'OECD average' is used to refer to these means.

How to read the bar charts

A thin vertical bar is used to show the mean and range of performance in each country for 90 per cent of the students. The highest point on the bar is the 95th percentile (the point on the scale above which the highest-scoring 5 per cent of the country's students are located) and the lowest is the 5th percentile (the point below which the lowest-scoring 5 per cent are located). The white block with a black line across it, located in the middle region of each bar, denotes the mean country score and gives an indication, through the height of the block, of the level of accuracy with which the mean was measured (the smaller the block, the more accurate the measurement).

In technical terms, the white block represents the mean and a region of about two 'standard errors' (SE) of the mean on either side of it. The most important point to remember in interpreting the comparative results presented in this chapter is that each country's result is an *estimate* of the total population value, inferred from the result obtained by the sample of students tested. Because it is an estimate, it is subject to error. If the mean were estimated from different samples drawn from the same population, the actual results for the mean would vary a little. However, we can be confident that the population mean lies between the value obtained from the sample and about two standard errors (1.96, to be exact) on either side of it. From statistical theory, we would expect the estimate of the mean from repeated sampling to fall within that range 95 times out of each hundred samples that were drawn.

To show more information about the distributions of results, each bar is divided into five regions, shaded differently to indicate the middle half of the students (those scoring between the 75th and 25th percentiles); the 30 per cent who scored either between the 75th and 90th or between the 25th and 10th percentiles; and the 10 per cent who scored either between the 90th and 95th percentiles or between the 10th and the 5th percentiles.

As an example, referring to the chart for reading literacy in total (Figure 2.1), we can see that Germany and New Zealand, followed by Belgium, the United States and Norway, had the widest spreads of scores achieved by the middle 90 per cent of students (those between the 5th and 95th percentiles), while Korea had much less spread than any other country. The OECD average difference in scale scores between the extremes of the middle 90 per cent was 328; for Germany it was 366, for New

[1] In addition to the overall country averages described above, the OECD computed means (which are referred to in the international report with the label 'OECD total') based on all sampled students from OECD countries who responded to the assessment. These means are not used for any comparisons in the Australian report and hence have been omitted from tables and figures.

Zealand, 356 and for Korea, only 227. The difference in Australia was 331, close to the OECD average. There is further discussion of spreads of scores later in the chapter.

As a second example, we can also see from Figure 2.1 that almost 75 per cent of the students in Finland scored above the OECD average in reading literacy, while more than 75 per cent of the students in Brazil and Mexico and close to 75 per cent of the students in Luxembourg scored below this level.

Between-country similarities and differences

The charts can be used as a guide to whether a country's mean score is significantly different from another country's mean score. For the means to be significantly different, the white blocks on the countries' bars should not overlap on the vertical (the scores) scale.[2] For example, the superiority of Finland in reading can readily be seen, in that its white block in Figure 2.1 does not overlap the white block of any other country. Some countries have relatively wide white blocks, most noticeably Japan and the United States, leading to fewer significantly different comparisons of results. Larger standard errors typically result from lower response rates or from differences in sample sizes or sampling methods.

Each country will no doubt wish to judge between-country results with itself as the main reference point. To facilitate this for Australia we have included shaded background zones on each of Figures 2.1 to 2.6, as follows:

- Countries in the darker shaded zone on the left-hand side of each chart are the countries whose PISA students performed significantly less well, on average, than the Australian PISA students;
- Countries against the white background are those whose students performed at an equivalent level to the Australian students;
- Countries in the light-shaded zone at the right-hand end of each chart are the countries whose students performed significantly better, on average, than the Australian students.

Most of the apparent differences between adjacent countries on the charts, and usually also between several adjacent countries as a group, are attributable to sampling and measurement errors.

The full international multiple comparison charts, from which the charts in this Australian report were derived, are included in Appendix 3.

>> *Results*

Australia's comparative results in summary

Before detailed discussion of the bar charts, an overview of Australia's results is included here in the form of a table showing Australia's mean and standard deviation on each scale and sub-scale, together with the results for the lowest-scoring country, the lowest-scoring OECD country and the highest-scoring country (always an OECD country) in each case. Australia's results were consistently and significantly above the international means. The standard deviations were within five points of the OECD standard deviation for three of the results shown, sometimes higher and

[2] Note that an adjustment has to be made to this rule of thumb when many pairs of countries' results are being compared simultaneously.

sometimes lower. For reading: reflecting and for both mathematics and science, the spread of Australia's results was narrower, by more than five points, than the spread of the OECD results.

Australia's results were consistently and significantly above the OECD means.

Table 2.3 Overview of Australia's Performance*

Literacy domain	OECD average	Lowest-scoring country	Lowest-scoring OECD country	Highest-scoring country	Australia
Reading	500 (100)	396 (86)	422 (86)	546 (89)	528 (102)
Retrieving information	498 (111)	365 (97)	402 (101)	556 (102)	536 (108)
Interpreting texts	501 (100)	400 (84)	419 (78)	555 (97)	527 (104)
Reflecting on and evaluating texts	502 (106)	417 (93)	442 (115)	542 (96)	526 (100)
Mathematics	500 (100)	334 (97)	387 (83)	557 (87)	533 (90)
Science	500 (100)	375 (90)	422 (77)	552 (81)	528 (94)

* Except for the first column, results are country means. Standard deviations are shown in parentheses.

Comparative results in reading literacy

While a gap of at least 16 points in mean results between the highest-scoring country and Australia is evident from Table 2.3, there were either no countries or only a small number of countries that achieved results higher than Australia's in absolute terms. These countries are identified in the discussions below. They can be seen, together with their mean scores, on the charts in this chapter. Figure 2.1 presents the international results for the total reading literacy test, which is made up of the three sub-scales for which the results are separately shown in Figures 2.2 to 2.4 (for detailed descriptions of the skills assessed in the sub-scales, see the next chapter). An example of the international tables of results from which these figures were constructed is included in Appendix 3. Each figure is discussed from an Australian perspective in the following paragraphs.

Reading literacy: total

Finland clearly 'scooped the pool' in reading literacy, scoring significantly higher than all other countries on the total reading measure, as shown in Figure 2.1. Eight countries formed a second group, from Canada to Sweden on the chart, with scores not significantly different from Australia's. The United States, while not really a part of this group when its results were compared with those of several of the countries in the group, also had results that were not significantly different from Australia's when based on multiple comparisons.[3] Twelve countries, from Finland to Iceland on the chart, achieved results significantly above the OECD average, 14 countries achieved results significantly below this average and five countries' results were equivalent to it. All English speaking countries except the United States were in the 'above average' group.

Only Finland's performance was significantly better than Australia's in reading literacy.

Only Finland scored significantly higher than Australia on the total reading measure, while Australia achieved significantly higher results than 21 countries.

[3] In this chapter the comparisons made are of each country's performance in relation to that of every other country. Tests for significant differences have to be adjusted to allow for many comparisons' being made simultaneously. A probability level of .05 has been used throughout the report to test for the significance of differences. (For further explanation, see the Glossary.)

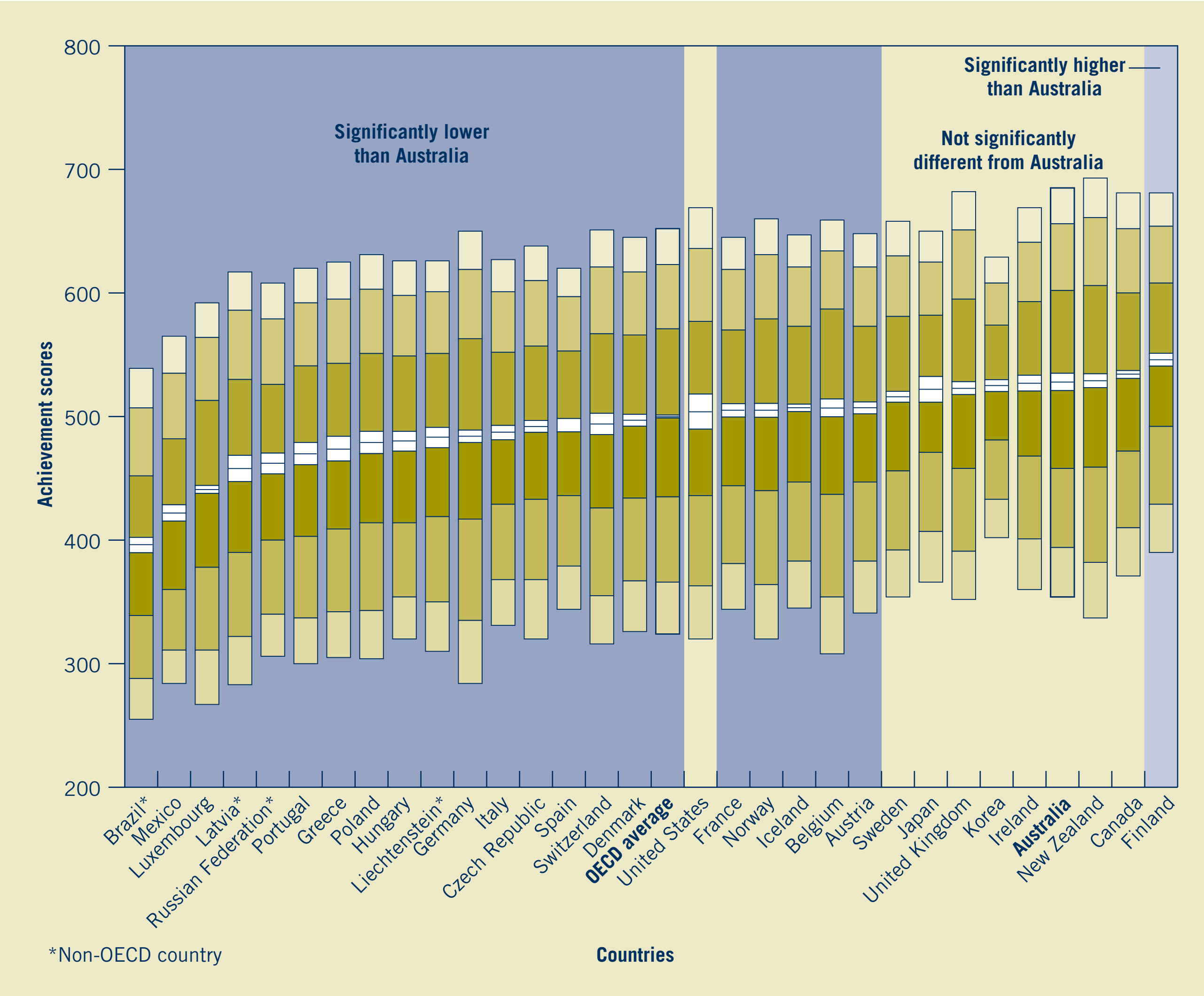


Figure 2.1 Student Achievement by Country on the Combined Reading Literacy Scale

Reading literacy: retrieving information

Results on the reading literacy sub-scales were similar on the whole to the results for the reading measure overall. The separate charts for the sub-scales are included here because some countries shifted in the rank ordering of the best estimates of results. For the retrieving information sub-scale, shown in Figure 2.2, Finland again performed significantly better than any other country. Australia was at the head of the second group of seven countries, all achieving results significantly lower than Finland's but not significantly different from Australia's result. The Australian students achieved significantly higher results on this reading sub-scale than their counterparts in 23 countries, from Sweden to Brazil on the chart. The United States was the only English speaking country to achieve significantly lower results than Australia.

Finland's students were the only ones to perform better than Australia's students, on average, in retrieving information ....

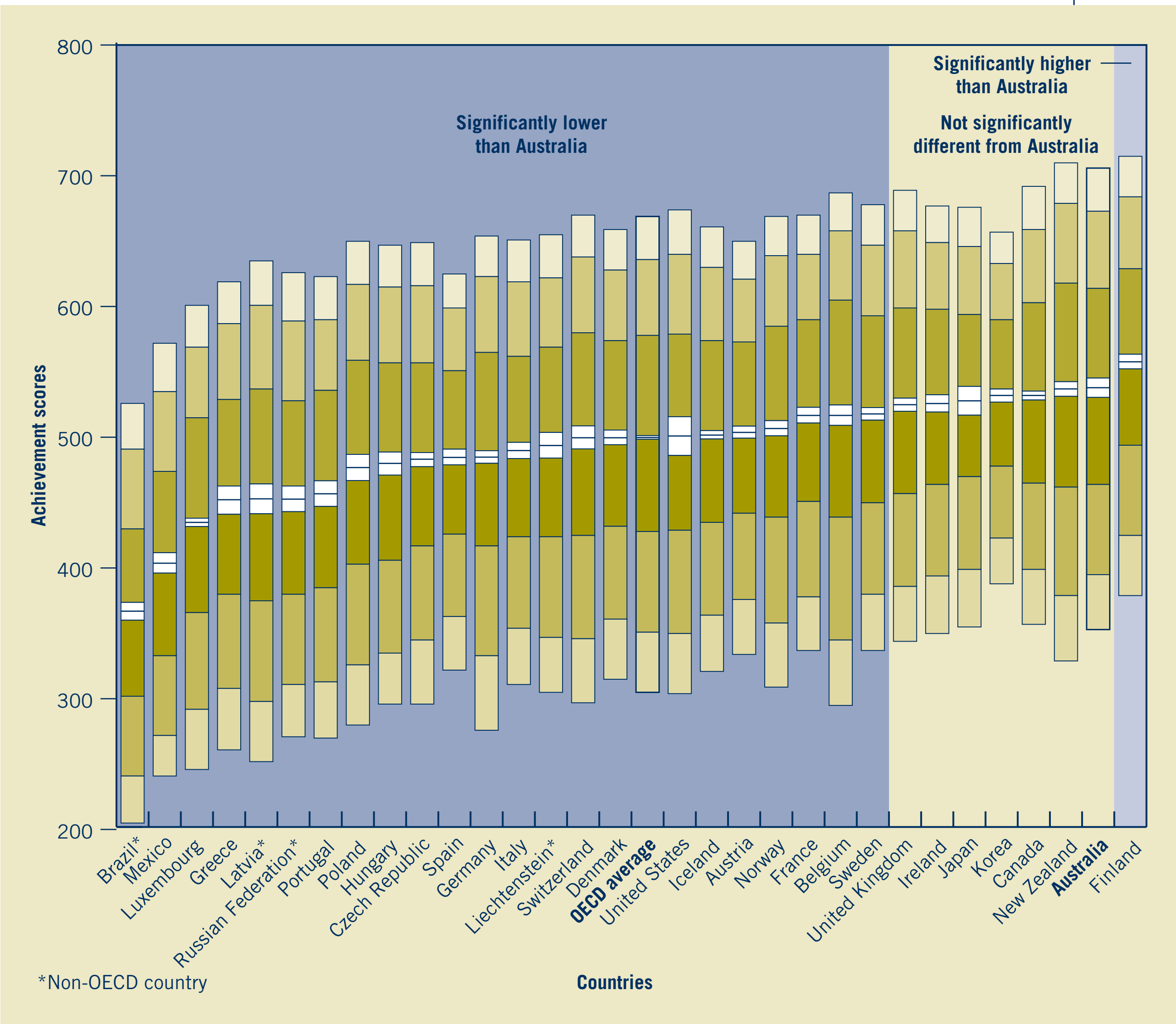


Figure 2.2 Student Achievement by Country on the Reading: Retrieving Information Sub-scale

Reading literacy: interpreting texts

The superiority of Finland's results is again evident on the interpreting texts sub-scale, as shown in Figure 2.3. Following Finland is a group of seven countries, from Canada to Japan, with results equivalent to Australia's but significantly below Finland's. Australia's result was again significantly higher than the results of 23 countries, including the United Kingdom in this case as well as the United States.

…. and in interpreting texts, ….

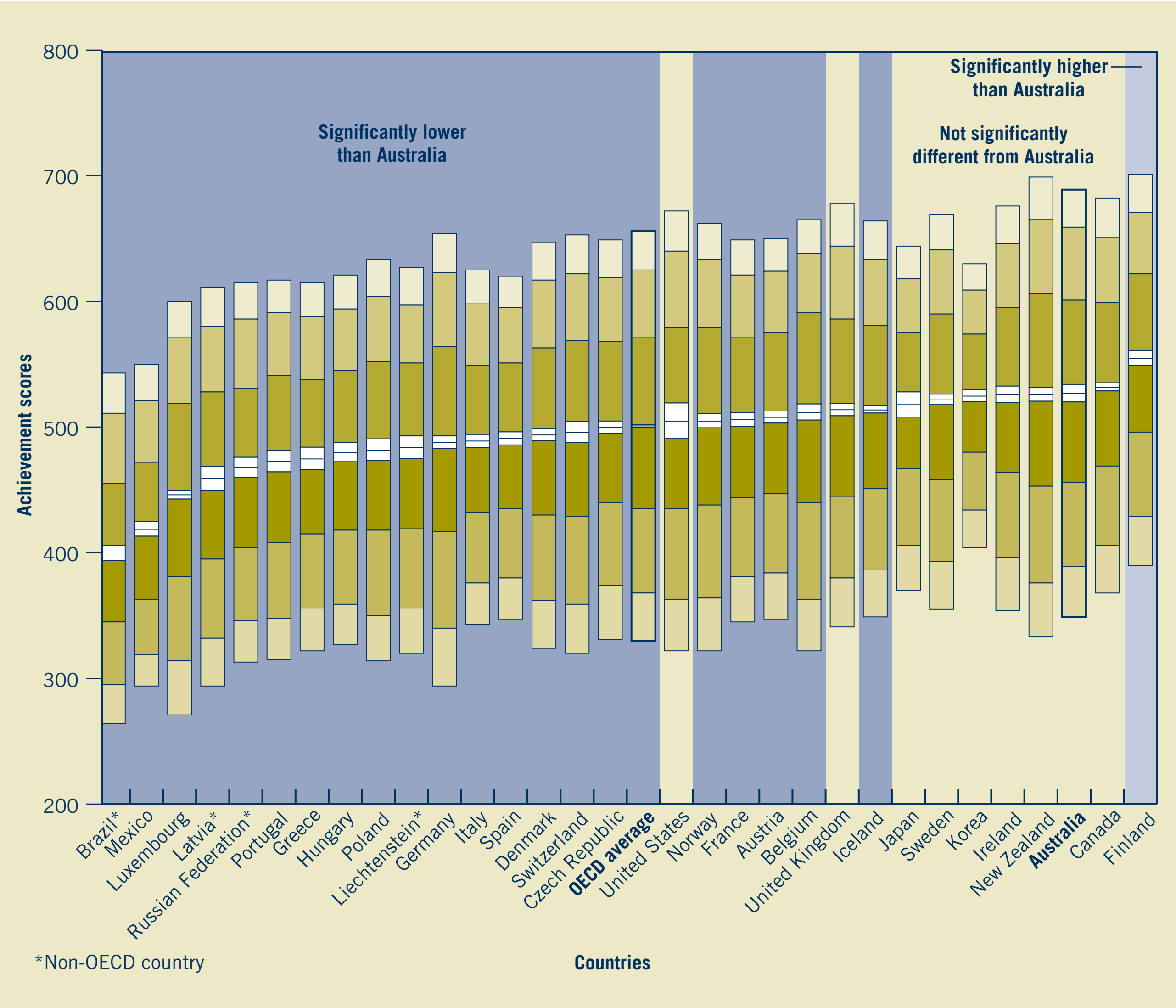


Figure 2.3 Student Achievement by Country on the Reading: Interpreting Texts Sub-scale

Reading literacy: reflecting on and evaluating texts

On the reading literacy sub-scale requiring the skills to reflect on and evaluate what one has read, Finland's result could not be distinguished significantly from the results of Canada, the United Kingdom, Ireland, Japan, New Zealand, Australia and Korea. Of these countries, however, Canada's result was significantly higher than New Zealand's, Australia's and Korea's. Canada shows in Figure 2.4 as the only country with a superior result to Australia's. The Australian students scored at an equivalent level to the students from the United Kingdom to Korea on the chart, plus the United States, and outperformed the students from 22 countries.

.... while Canadian students were the only ones, on average, who performed better in reflecting on and evaluating texts.

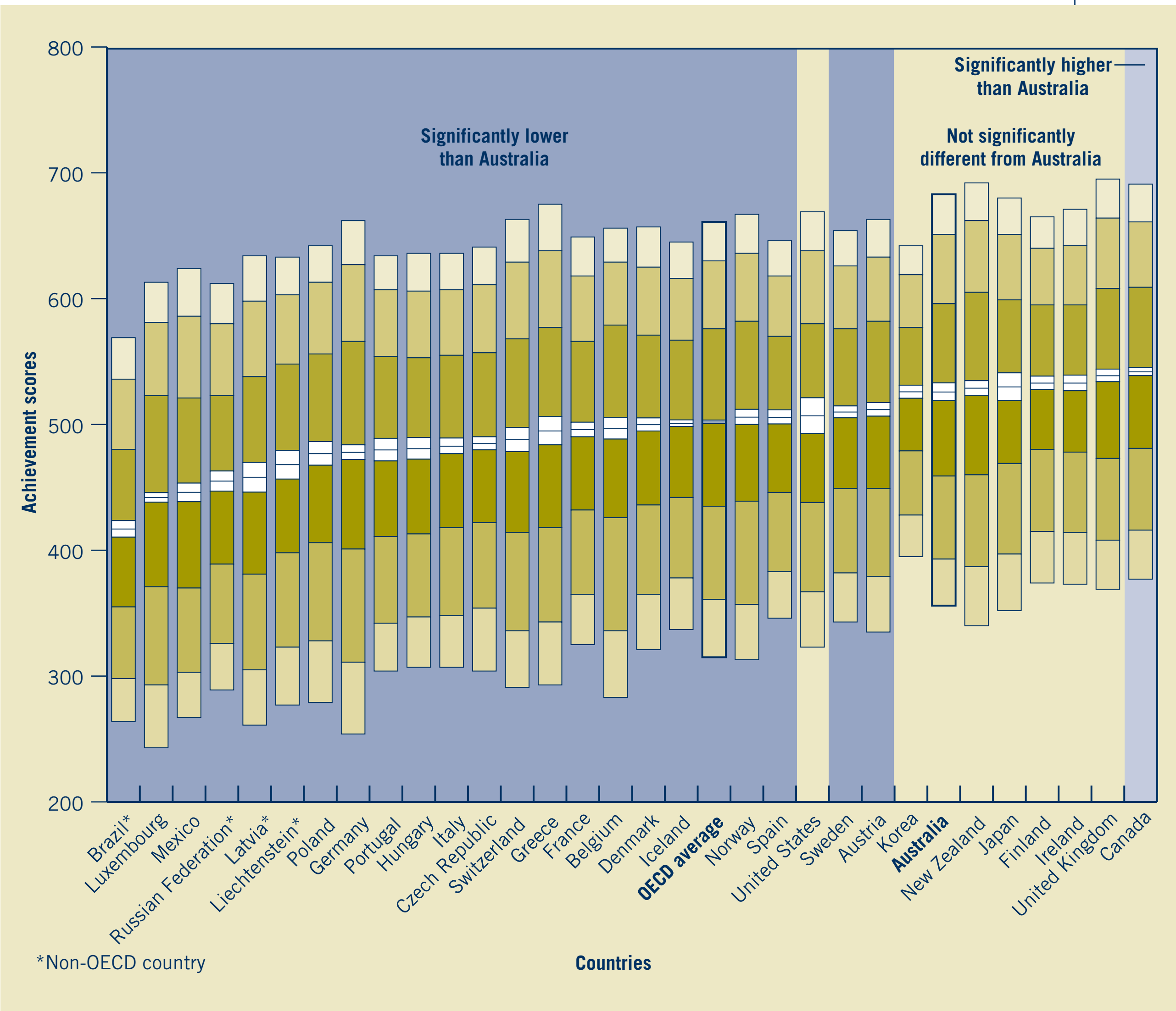


Figure 2.4 Student Achievement by Country on the Reading: Reflecting on and Evaluating Texts Sub-scale

Results across sub-scales

The overall similarity in the results by reading sub-scale of the highest-achieving eight countries is evident from the charts. For example, mostly the same countries appear in the top eight, though they have moved around a little in rank order position. The only inconsistency in the top eight by sub-scale is that Sweden displaced the United Kingdom on interpreting texts. With this one exception, five of the six English speaking countries were among the top eight on all aspects of reading achievement.

Texts in several languages, details of which are given in the international report, were submitted to the PISA international consortium for possible inclusion in the assessment booklets. Rigorous translation procedures were used to ensure that texts and items would be as equivalent as possible in difficulty and meaning in all languages. Thus, while it is possible that there is a language effect tending to favour English speaking countries, what may be more likely is that students from English speaking countries are more familiar with the kinds of assessment tasks used and are more developed in the skills needed to respond successfully to them than students from lower achieving countries. It would be useful to investigate this hypothesis in further research.

Almost half of the OECD countries, including Australia, showed little differentiation of achievement between the three sub-scales, achieving mean sub-scale results within a 10-point range. The retrieving information and interpreting texts sub-scales were more similar in their results than either of these sub-scales compared with the reflecting on and evaluating texts sub-scale. Only six countries had differences greater than 10 points between their ‘retrieving’ and their ‘interpreting’ results, all achieving a higher actual result on the latter. The countries were Greece, where the largest difference of 25 points occurred, the Czech Republic, Portugal, Mexico, Iceland and Luxembourg.

Australia’s performance was comparatively consistent across the three reading process sub-scales.

By contrast, the comparison between the ‘retrieving’ and ‘reflecting/evaluating’ sub-scales showed more than half the countries achieving means within 10 points of each other on the two sub-scales, but, where differences were found, they were larger and spanned a wider range. The largest difference, of 45 points, again occurred in Greece, with Mexico also recording a difference of more than 40 points. Both of these countries performed better in reflecting/evaluating than in retrieving information. Other countries with a similar pattern, but lesser differences spanning 12 to 25 points, were Canada, the United Kingdom, Spain and Portugal. Countries with differences in the opposite direction were Finland (23 points higher in retrieving information than in reflecting/evaluating), France and Belgium (19- and 18-point differences, respectively).

Distributions of reading literacy results

Combined reading literacy scale

In an ideal world, in terms of educational performance, a country would strive to have its students achieve a high overall average result together with a small spread of results between the lowest and highest performers. From the discussion in the section on ‘How to read the bar charts’, we saw that Korea came closest of any OECD country towards attaining this goal in reading literacy. Assuming that countries are concerned about inequalities of outcomes, it is equally informative for them to consider disparities in their students’ PISA results as it is to consider what the students achieved on average. For example, we saw above that the largest difference between the 5th and 95th percentiles of PISA reading literacy results was 366 score points (in Germany). The distributions are discussed further here.

A typical characteristic of statistical distributions, where human attributes are being measured, is that results are bunched in narrower score ranges close to the mean and are more spread in score ranges further away from the mean. This pattern can be seen in Figure 2.1 for the overall reading literacy results and in Figures 2.2, 2.3 and 2.4 for the three sub-scales (and also in the figures for mathematical and scientific literacy presented later in the chapter). What is interesting for an individual country is to see where it stands, relative to other countries, in the degree of disparity of results between groups of its lower and higher performers. The less disparate the results, the closer a country is to the goal of achieving equality of outcomes.

Korea, with a spread of only 227 scale points between the 5th and 95th percentiles of its distribution, is the best example from PISA of a country that has been relatively successful in achieving this goal. For the OECD overall, the spread of scores in this percentile range was 328. Germany had the largest spread (366) for this range, followed by New Zealand (356). Thus, the country with the largest spread was 38 points away from the OECD average. The spread in Australia was 331, close to the OECD average. The difference in Australia was also close to the OECD average difference for the middle 80 per cent of students (those between the 10th and 90th percentiles).

Korea has been relatively successful in reducing disparity between its best and poorest readers.

The international report (OECD, 2001) focuses its discussion of distributions on the middle half of the students – between the 25th and 75th percentiles – in terms of their reading literacy results on the total test. In all but five OECD countries, the variation in performance between students at the 25th and 75th percentiles is greater than the difference between the mean scores of the highest and lowest performing countries. The OECD average difference was 136 points for this percentile range, while in Australia the difference (144 points) became relatively larger with respect to the OECD average than it was for the middle 80 or middle 90 per cent of the distribution. In this instance, the country with the largest difference (150 points) was Belgium. Korea remained an outlier, with a difference of only 93 points between the highest and lowest achievers in the middle half of its reading literacy distribution. Clearly Korea has succeeded better than any other country in bringing the reading skills of the lowest quarter of its students closer to the reading skills of its highest achievers.

The spread of reading scores within countries tended to be much greater than the spread of country means.

The larger-than-OECD-average gap between the 25th and 75th percentiles in reading literacy in Australia was due to the interpreting texts sub-scale. The distribution of results on this sub-scale, which contains half of the total number of reading items, has a greater influence on the overall results than does the distribution on either of the other two sub-scales. On interpreting texts the difference between the 25th and 75th percentiles in Australia was greater than the OECD average difference, whereas on the other two sub-scales the gap between the 25th and 75th percentiles was the same as or less than for the OECD as a whole. Details are provided in the following paragraphs.

Reading: retrieving information sub-scale

On the retrieving information sub-scale, Australia's result for each of the comparisons made between percentile range groups was either close to or lower than the OECD average, and lower by the greatest amount for the 5th to 25th percentile comparison (a difference of 111 scale points in Australia compared with the OECD average difference of 123). This implies that, relative to many other countries, progress has been made in Australia in raising the reading skill levels of students at the low end of the distribution. The largest within-country differences in outcomes for the students in this relatively low achievement range occurred in Belgium (144 scale points), followed by Germany (141 points) and New Zealand (133 points). The spread of results for the middle half of the Australian students (150 points) was exactly the same as the OECD average.

Reading: interpreting texts sub-scale

As mentioned above, the middle half of the distribution of Australian results in interpreting texts was more spread out than the corresponding group across the OECD. The 25th and 75th percentiles of the distribution in Australia were 145 points apart, whereas across the OECD they were 136 points apart. On this sub-scale the 5th to 25th percentile range group achieved results at the OECD average (around 105 points) and all other comparison groups within Australia showed greater differences than the corresponding OECD average differences.

Reading: reflecting on and evaluating texts sub-scale

For reflecting on and evaluating texts, only the score range for the middle half of the Australian distribution was similar to the OECD average score range. For all other comparisons of percentile range groups, the Australian results are less spread than the OECD results. For example, between the 5th and 95th percentiles, the OECD average difference was 346 scale points, while in Australia the corresponding difference was 327 scale points. Of possibly more interest is that, for the students in the 5th to 25th percentile range, the score difference in Australia was 103 scale points compared with the corresponding OECD difference of 120 points. The biggest within-country differences in outcomes for the 5th to 25th percentile range again occurred in Germany (147 points) and Belgium (143 points), but not in New Zealand where the difference in this case was exactly at the OECD average of 120 points. As for the retrieving information sub-scale, it appears that, relative to many other countries, progress has been made in Australia in raising the reading skill levels of students at the low end of the distribution.

Some progress has been made in Australia in raising the reading skills of low achievers.

Highest-performing students

Assuming that countries will wish to have their students performing at a high level on the PISA measures and to maintain the achievements of their top students while at the same time minimising the differences in performance between the lowest and highest scorers, it is informative to see how well the highest achievers in each country performed. Several of the countries that performed best overall were also found in the top-ranked countries based on the highest five per cent of their students, but there were some exceptions. For example, Belgium and Greece joined the top group of countries on the reflecting/evaluating sub-scale based on the results of their highest achievers, but had only average achievement overall on this sub-scale.

The comparisons for the highest achievers in each country in reading literacy and on the reading literacy sub-scales are included in Appendix 3 (Tables A3.6 to A3.9). The tables show the average score of the top 5 per cent of students per country. On all of these comparisons, no country scored significantly higher than Australia. On the combined reading literacy measure, New Zealand, Australia, the United Kingdom, Finland and Canada headed the list, forming a group with equivalent results. Ireland and the United States formed an intermediate group between the highest group and the rather large middle group, with results mostly not significantly different from those of the first group but equivalent to those of many more countries than was the case for the five named in the highest group. The 10 countries from Norway to France formed the middle group; the Czech Republic, Poland and Liechtenstein formed an intermediate group between the middle group and the third main group of eight countries, with Luxembourg, Mexico and Brazil at the tail end.

The top 5 per cent of Australia's students performed on a par in reading literacy with the best students in the world.

For retrieving information, the top five per cent of students in Finland, New Zealand, Australia, Canada, the United Kingdom and Belgium achieved the highest results on average. Only New Zealand and Australia performed at an equivalent level to Finland. New Zealand and Australia performed significantly better than all countries except those in the top group listed here. Canada's performance was significantly better than that of 21 countries, while the United Kingdom and Belgium each outperformed 19 countries. The top five per cent of students from the same three countries also performed best on the interpreting texts sub-scale, in terms of the within-country average score obtained by these students. Again, Finland outperformed all countries except New Zealand and Australia, but in this case New Zealand's and Australia's results were not significantly different from those of the other English speaking countries. On the reflecting/evaluating sub-scale, the top five per cent of students from each of the United Kingdom, New Zealand, Canada, Australia, Japan, Greece and the United States all achieved results equivalent to each other on average, but only the United Kingdom, New Zealand and Canada stood out as out-performing all other countries. Australia achieved significantly better results than those of 19 countries.

Adding to the results based on distributions

The reading literacy results are given more meaning in the next chapter, where the reading skills that students at various levels of achievement are likely to possess, and what the students at the various levels of achievement can be expected to be able to do, are analysed and discussed. These analyses, considered together with the results given in the present chapter, provide better information on which to base policy decisions than the results in this chapter on their own.

Comparative results in mathematical literacy

From Figure 2.5, in which the country means and distributions of results on the mathematical literacy scale are shown, it can be seen that Japan was the only country to perform significantly better than Australia. Japan's overall superiority in mathematics was not quite as clear-cut as Finland's in reading, in that its results were equivalent to the results of two other countries: Korea and New Zealand. From Australia's perspective, Korea and New Zealand were among the seven countries with equivalent results to Australia's, from Korea to Belgium on the chart, plus Liechtenstein (which had a large standard error of the estimate of its mean, and is therefore not distinguished statistically from as many countries as is typical for other countries). Twenty-one countries performed at a significantly lower level than Australia.

Japanese students were the only ones to perform significantly better, on average, than the Australian students in mathematical literacy.

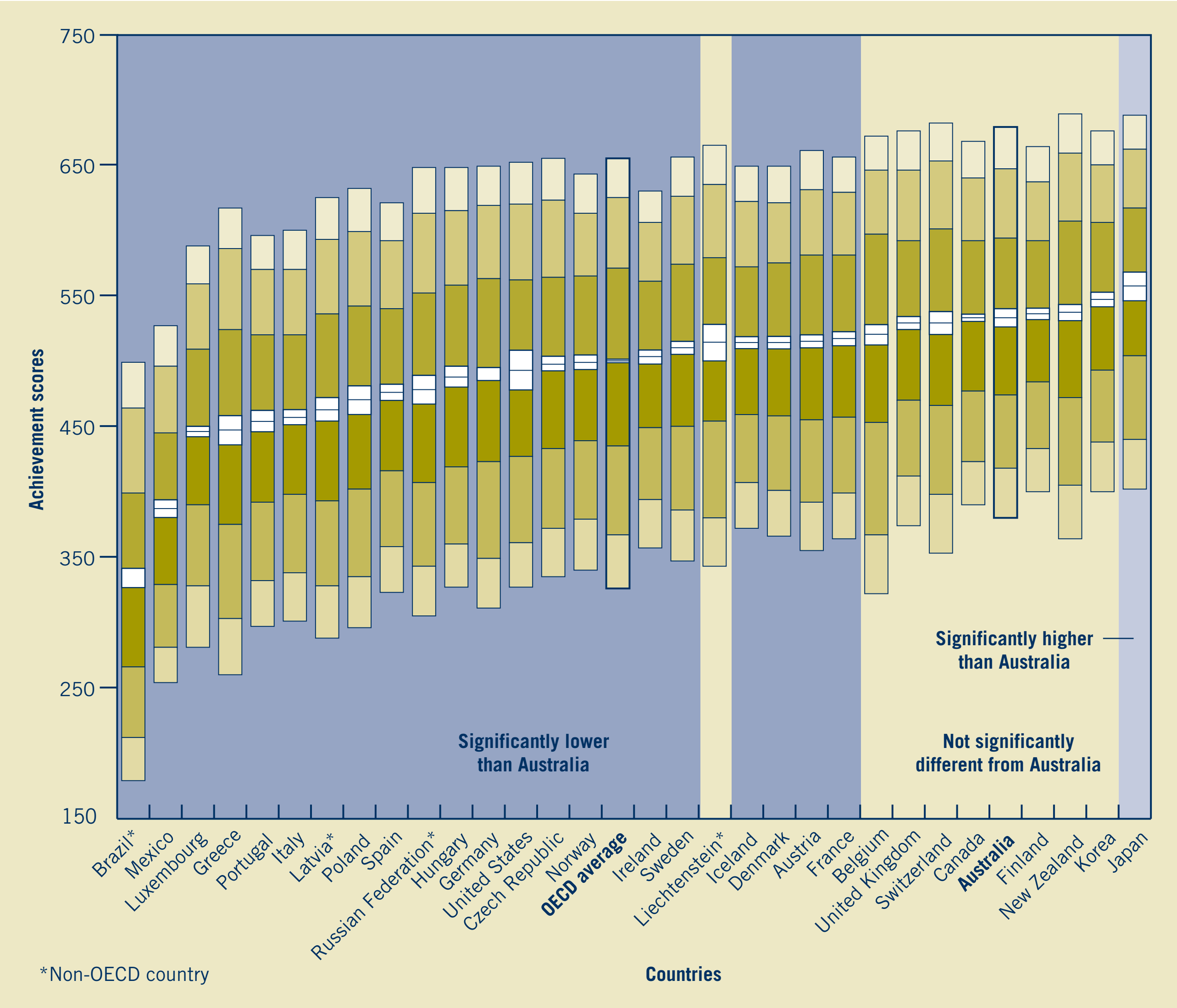


Figure 2.5 Student Achievement by Country on the Mathematical Literacy Scale

Fifteen countries performed significantly above the OECD average, from Japan to Sweden on the chart. A further four countries: Ireland, Norway, the Czech Republic and the United States, had results equivalent to the OECD average and 12 countries, from Germany to Brazil on the chart, achieved results significantly below this average. As for reading literacy, all English speaking countries except the United States were in the 'above average' group.

Distributions of mathematical literacy results

The widest spreads of mathematical literacy results were found in Greece, Belgium and the Russian Federation, followed to a lesser extent by Germany and Poland. In contrast with reading literacy, where some of the highest achieving countries were among those which also had the widest within-country disparity in results, all of the countries listed here, except Belgium, were in the lower half of countries in terms of mean achievement. The best students in Belgium achieved very high results, well above the OECD average for the top 5 per cent of students, but the gap between the 5th and 25th percentiles in this country was much larger than for any other country.

Ireland, Mexico, Finland, Iceland and Canada joined Korea in having the most compact distributions of results. This is an interesting set of countries, as they come from all parts of the list of countries ordered by mean achievement. Korea, Finland and Canada were among the highest overall performers in mathematical literacy, Mexico was one of the lowest performers overall, Ireland was placed at the OECD average and Iceland slightly above this average.

The spread of mathematical literacy results in Australia (299 score points between the 5^{th} and 95^{th} percentiles), significantly less than the OECD average spread (329 score points), was much more compact than for reading literacy. Similarly, the difference in scores between the 5^{th} and 25^{th} percentiles in Australia (94 points) was considerably less than the corresponding difference for the OECD as a whole (111 points). As with the reading sub-scales for retrieving information and reflecting/evaluating, this result for most of the lowest achieving students suggests progress in Australia towards bringing their mathematics skills closer to those of the higher achievers.

Australia has also made progress, relative to many countries, in raising its lowest achievers' mathematics skills.

Highest-performing students

The PISA test design, with items rotated through nine booklets and only 32 items for mathematics as a minor domain in PISA 2000, meant that only five-ninths of the students responded to mathematics items. Thus, the numbers of students per country with mathematics results[4] are smaller than for reading and the standard error terms are consequently larger. Larger differences in mean scores are therefore needed for comparisons to be significant. Nevertheless, New Zealand, Japan, Switzerland, Australia, the United Kingdom, Korea, Belgium, Canada and Liechtenstein showed as performing significantly better on average than most other countries in terms of the results obtained by their highest achieving students. (An exception within this group was that Canada's result was significantly lower than New Zealand's.) Finland and Austria also performed relatively well, with only the highest-performing groups in each of New Zealand and Japan achieving significantly better results.

The top 5 per cent of Australia's students also performed at the same level in mathematical literacy as the best students in the world.

Adding to the results based on distributions

As for reading literacy, the results in the present chapter for mathematical literacy are elaborated in a later chapter, in this case Chapter 4.

Comparative results in scientific literacy

Two countries, Japan and Korea, outperformed all other countries in scientific literacy and a further two countries, Finland and United Kingdom, outperformed all but Japan and Korea. The comparative results from Australia's perspective are shown in Figure 2.6. Australia was one of seven countries with equivalent results, including Finland and the United Kingdom and going down to Ireland on the chart. Australia was outperformed only by Japan and Korea. The students from twenty-two countries, from Sweden to Brazil, performed at a significantly lower level than the Australian students.

Students in Japan and Korea performed significantly better, on average, than Australian students in scientific literacy.

[4] Population estimates can still be validly computed from the sample results, but different sets of sampling weights from those applied for reading have to be used.

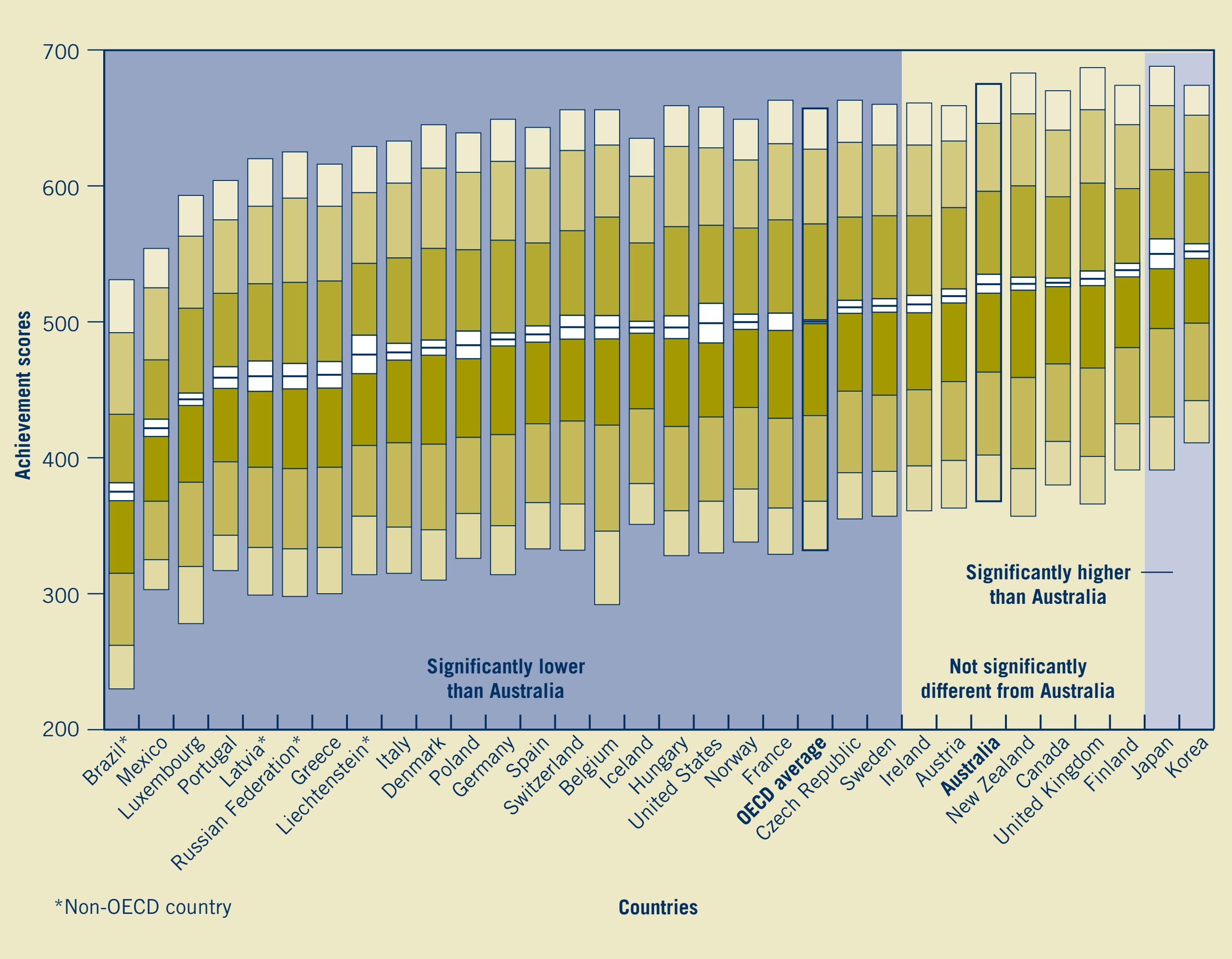


Figure 2.6 Student Achievement by Country on the Scientific Literacy Scale

Eleven countries performed significantly above the OECD average, from Korea to the Czech Republic on the chart and thirteen countries, from Spain to Brazil, achieved results significantly below it. The seven countries from France to Switzerland on the chart performed at a level equivalent to the OECD average.

Distributions of scientific literacy results

As for mathematical literacy, Belgium had the widest spread of results between the 5th and 95th percentiles in scientific literacy. All other countries were much closer to the OECD average difference between these percentiles. Mexico and Finland joined Korea in having the most compact distributions of results. Australia's results were distributed over a narrower range than the OECD average for all comparisons between percentile groups except for the lowest achieving students, those between the 5th and 25th percentiles, where the difference in Australia (95 points) was similar to the OECD difference (99 points). Relative to the OECD as a whole, it appears that less progress has been made in science than in mathematics in raising the skill levels of students at the low end of the distribution.

Less progress has been made in Australia in raising low achievers' science skills than their mathematics and reading skills, ….

Highest-performing students

The same caveat as outlined above for mathematical literacy, about standard errors being larger and larger differences therefore being needed for significance in comparisons for the highest within-country performers, is also relevant for scientific literacy. However, it is possible to identify Japan, the United Kingdom, New Zealand, Australia, Korea, Finland and Canada as forming a group of countries with equally high performance shown by their highest 5 per cent of students on the PISA scientific literacy component. France, the Czech Republic and Ireland also performed well, with only the highest performers from Japan and the United Kingdom achieving significantly higher results than the corresponding groups from these three countries. A few countries (not among those with the highest actual results) had such high standard errors that it made little sense to include them in the multiple comparisons. (See Table A3.15 in Appendix 3.)

…. but the top 5 per cent performed at the same level in scientific literacy as the best students in the world.

Adding to the results based on distributions

As for reading literacy and mathematical literacy, the results in the present chapter for scientific literacy are described in a later chapter (Chapter 4 in this case) in terms of ranges of demonstrated skills rather than in terms of relative positions in distributions.

>> *Results by gender*

It is particularly interesting to consider the Australian PISA results by gender for two reasons. The first is the progress made towards gender equity in mathematics and science evident in the Australian TIMSS results, where we were one of only six countries with no significant difference in the results achieved by males and females in the two adjacent grades containing the majority of 13-year-olds. Further, we were one of only five countries with equivalent results by gender in advanced mathematics at Year 12, though a substantial gap in favour of males remained in Year 12 physics and also on more general mathematics and science tests designed for non-specialist students. (Even so, there were many countries with gender differences in Year 12 achievement up to twice as large as those found in Australia.) In the repeat of TIMSS carried out at lower secondary level in 1998-99, significant gender differences were found in only four of 39 countries in mathematics but in almost half the countries in science. Australia was not among the countries with significant differences.

The second reason is the recent concern and topical debate in Australia about a decline in boys' achievement in many academic areas relative to that of girls.

In this chapter, males' and females' results are discussed for Australia as a whole. There is further consideration of gender differences in Chapter 5, where results for groups within Australia are presented.

Reading literacy

On the overall reading literacy scale, with a mean of 500 and standard deviation of 100 for OECD countries, the females' mean score was 32 points above the males' score for the OECD as a whole, or about a third of a standard deviation. All gender differences were significant, ranging from a low of 14 points in Korea to highs of 53 points in Latvia and 51 points in Finland. Next highest were New Zealand and Norway, with differences of 46 and 43 points, respectively. The difference was 30 points or more in 19 of the 31 participating countries. In Australia the gender gap on the total reading literacy scale was 34 points, approximately the same as the OECD difference.

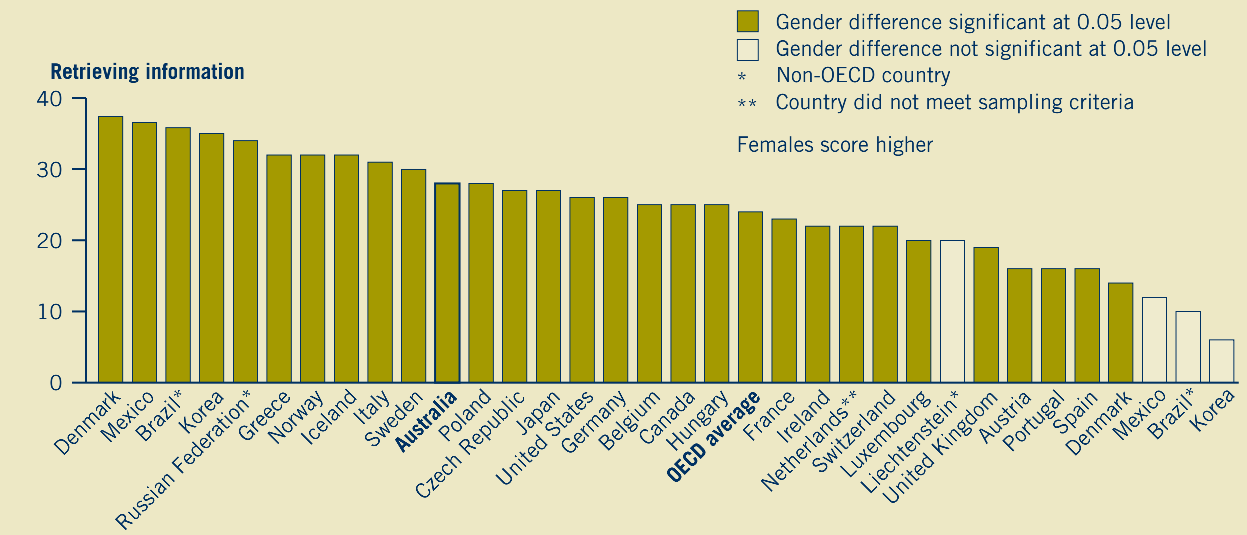
Females performed significantly better than males in all countries in reading. The gender difference in Australia was the same as the OECD average.

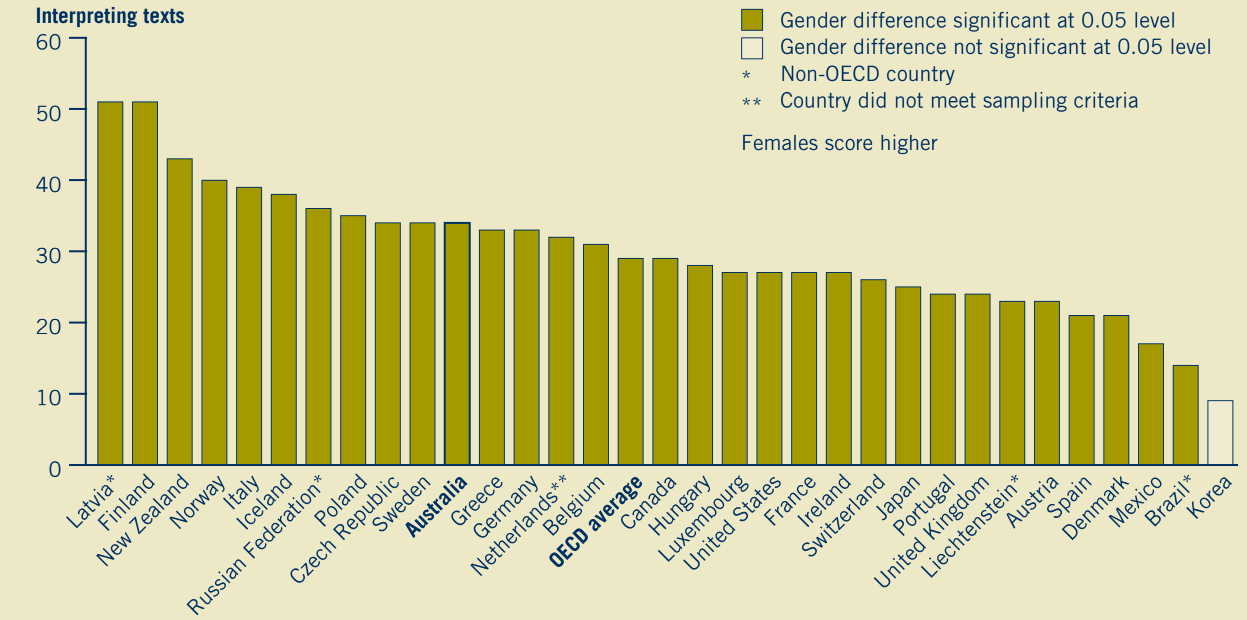
The same pattern persists through the reading sub-scales, though in a small number of cases the differences were not significant on the retrieving and interpreting sub-scales (most notably in Korea). Differences were most pronounced on the reflecting sub-scale in all countries, reaching highs of 71 points in Latvia and 60 points in Norway. The OECD average differences between females' and males' results on the three reading sub-scales were 24 points for retrieving information, 29 points for interpreting texts and 45 points for reflecting on and evaluating texts. In Australia the corresponding differences were 28 points, 34 points and 42 points, respectively. Australia, along with the United States and Brazil, had more uniform profiles of gender differences in achievement among the three reading processes. Results on the reading literacy sub-scales are shown by gender in Figure 2.7. The gender differences for the total reading scale were very similar to those shown for interpreting texts, the main difference being that Korea's result was significantly different on the total scale.

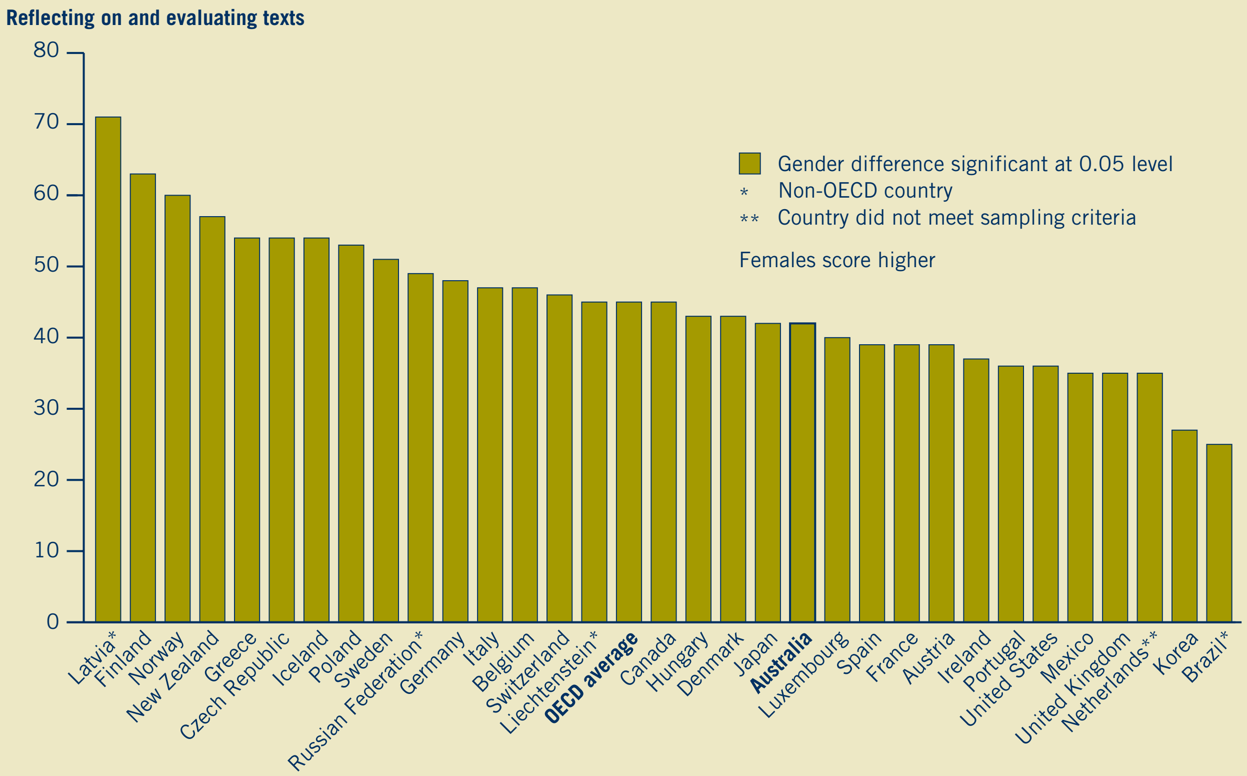
As pointed out in the international report, the magnitude of gender differences in reading literacy by country shows no clear relationship with overall level of achievement by country. Finland and New Zealand were both high achieving countries, while at the same time having close to the largest gender differences. These countries' high achievement is to a large extent a result of the exceptional performance of their female students. Latvia had the highest gender difference but below average achievement. Korea, another high achieving country, had the lowest difference between males' and females' results.

Even though Finland had one of the largest gender differences in reading performance, Finnish males on average still performed at a level above the OECD average for reading literacy as a whole. An inspection of Figure 2.7 shows that this was due more to above average performance on the retrieving information and interpreting texts sub-scales than it was to performance on the reflecting on and evaluating texts sub-scale. As can also be seen in Figure 2.7, gender differences were greatest on the latter sub-scale in all countries. A plausible reason for this is that males and females may tend to engage with different kinds of reading material, with males preferring texts that do not require reflection or evaluation skills to process. Information on reading habits and attitudes collected in PISA is discussed in Chapter 6.

Figure 2.7 Achievement Differences on the Reading Sub-scales by Gender >>


Retrieving information
Gender difference significant at 0.05 level
Gender difference not significant at 0.05 level
* Non-OECD country
** Country did not meet sampling criteria
Females score higher
40
30
20
10
0
Denmark
Mexico
Brazil*
Korea
Russian Federation*
Greece
Norway
Iceland
Italy
Sweden
Australia
Poland
Czech Republic
Japan
United States
Germany
Belgium
Canada
Hungary
OECD average
France
Ireland
Netherlands**
Switzerland
Luxembourg
Liechtenstein*
United Kingdom
Austria
Portugal
Spain
Denmark
Mexico
Brazil*
Korea


Interpreting texts
Gender difference significant at 0.05 level
Gender difference not significant at 0.05 level
* Non-OECD country
** Country did not meet sampling criteria
Females score higher
60
50
40
30
20
10
0
Latvia*
Finland
New Zealand
Norway
Italy
Iceland
Russian Federation*
Poland
Czech Republic
Sweden
Australia
Greece
Germany
Netherlands**
Belgium
OECD average
Canada
Hungary
Luxembourg
United States
France
Ireland
Switzerland
Japan
Portugal
United Kingdom
Liechtenstein*
Austria
Spain
Denmark
Mexico
Brazil*
Korea


Reflecting on and evaluating texts
Gender difference significant at 0.05 level
* Non-OECD country
** Country did not meet sampling criteria
Females score higher
80
70
60
50
40
30
20
10
0
Latvia*
Finland
Norway
New Zealand
Greece
Czech Republic
Iceland
Poland
Sweden
Russian Federation*
Germany
Italy
Belgium
Switzerland
Liechtenstein*
OECD average
Canada
Hungary
Denmark
Japan
Australia
Luxembourg
Spain
France
Austria
Ireland
Portugal
United States
Mexico
United Kingdom
Netherlands**
Korea
Brazil*

Australia was not out of step with the majority of OECD countries in the extent of its differences in reading performance by gender. The Australian males' mean score in reading literacy overall (513, SE 4.0) was significantly above the males' mean for the OECD as a whole (485, SE 0.8). However, this does not mean that the males' significantly lower performance than females' in all aspects of reading in Australia can be ignored. At secondary level, one-third of a standard deviation difference in mean achievement is sometimes said to be roughly equivalent to a full school year level (see Beaton et al, 1996, for example). The PISA results by gender in reading literacy confirm current concerns about the need for effort to improve our male students' verbal skills.

The PISA reading results for males confirm current concerns about the need to raise males' levels of verbal skills.

Mathematical literacy

Differences in actual mean scores between males and females were very much less in mathematical literacy than they were in reading literacy, as can be seen in Figure 2.8. In many countries, including Australia, the differences were not statistically significant. Significant differences were recorded in 15 countries, predominantly European countries but also Canada and Korea, all in favour of males. Austria, Brazil and Korea shared the largest gender gap in mathematical literacy results. Although Korea had the largest gender gap, females in that country scored well above the OECD average, and at least as well as or better than the males from every other country except Japan.

Males achieved significantly better results in mathematical literacy than females in many countries, but not in Australia, where there was no significant difference.

Scientific literacy

There was no gender difference in mean scientific literacy performance for the OECD overall. Within-country results for males and females were either not significantly different or the differences that were found balanced out across countries. For 25 countries the gender comparisons were not significantly different from zero, as shown in Figure 2.8. Males in Korea, Austria and Denmark scored significantly higher than females and females outperformed males in Latvia, the Russian Federation and New Zealand.

There was no significant gender difference in scientific literacy scores in most countries, including Australia.

Comparisons with TIMSS results

In comparison with TIMSS, the 47 per cent of PISA countries with significant gender differences in mathematics performance lies between the 13 per cent of TIMSS-Repeat countries in this category for mathematics at eighth grade level, the 17 per cent likewise of the TIMSS countries and the 70 per cent of TIMSS countries for specialist mathematics at senior secondary level. For the mathematics literacy test used at senior secondary level in TIMSS, however, the percentage of countries with significant differences in performance by gender was even higher, at 86 per cent of countries, than it was for specialist mathematics. All significant differences in TIMSS results were in favour of males.

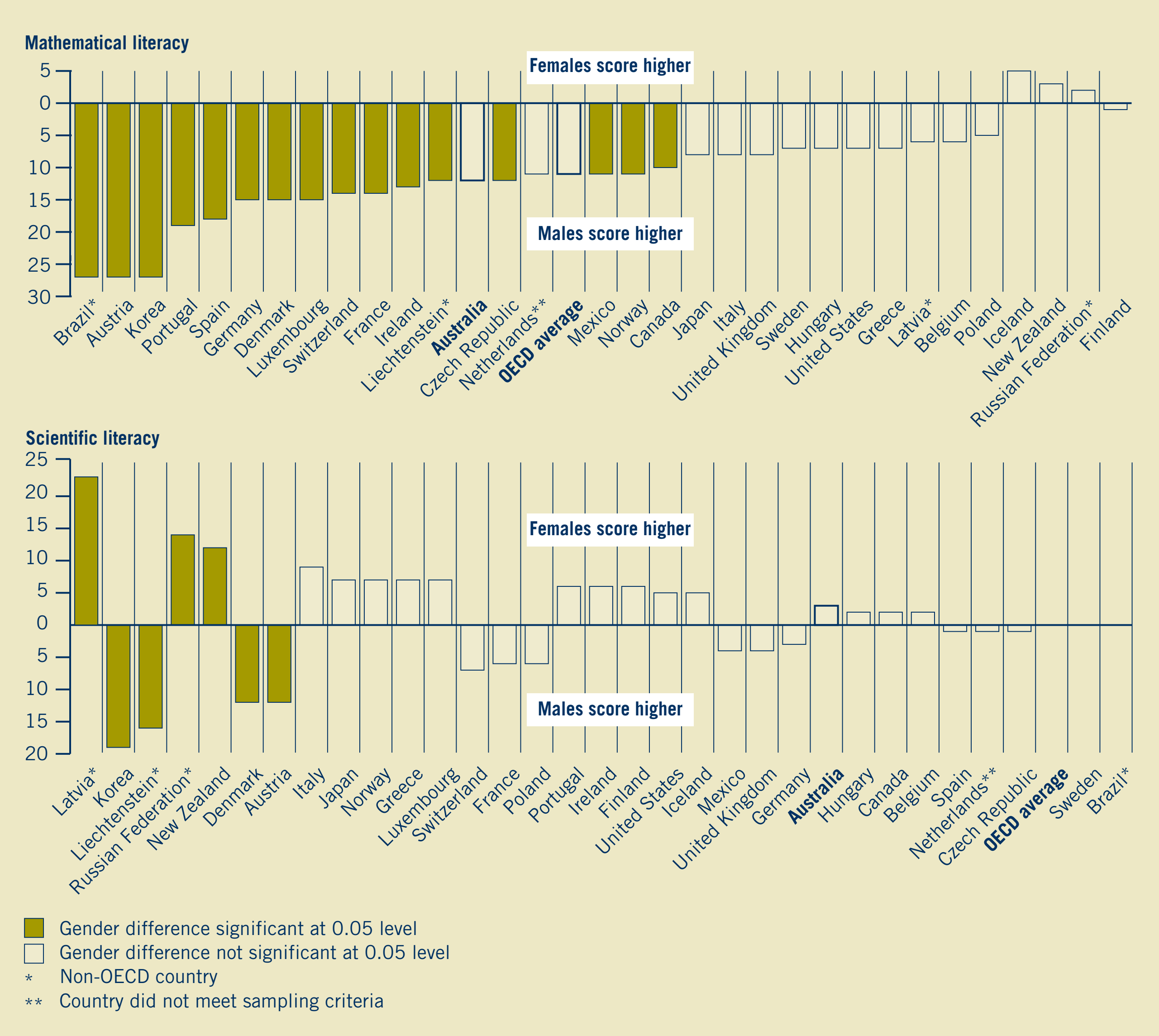


Figure 2.8 Achievement Differences on the Mathematical and Scientific Literacy Scales by Gender

There is a much more marked difference between the PISA scientific literacy results by gender and the analogous TIMSS results. At Population 2 (eighth grade) level in TIMSS, males significantly outscored females in science in three-quarters of the participating countries. At senior secondary level, males outperformed females in physics in 15 of 16 countries taking part in this component (the exception was Latvia, where the gender results were equivalent). At this level males also performed significantly better on the TIMSS scientific literacy test in 21 of 22 countries, South Africa being the exception in this instance. It follows that there was a significant gender difference in Australia at senior secondary level (TIMSS Population 3) in both physics and scientific literacy. At eighth grade, however, the science results in Australia were the same for males and females.

The differences in comparative results by gender between PISA and TIMSS probably reflect differences in the nature of the assessment instruments, at least in part. PISA 2000 contained a higher proportion than TIMSS of mathematics items requiring complex problem solving strategies or derivation of algebraic expressions, which tend to be done better by males. There were also fewer items in PISA than in TIMSS requiring manipulation of given algebraic equations or carrying out computations, which tend to be done better by females. Both of these circumstances would be likely to assist females more than they would assist males. In science, PISA's assessment placed a greater emphasis than TIMSS on life science (an area in which females usually perform well) while TIMSS had a greater emphasis on physics (an area in which males usually perform well). Further, the contexts for PISA's science items had a higher verbal loading than in TIMSS, and there is ample evidence in PISA of females' superior reading literacy skills.

>> *Australia's relative standing in cross-curricular areas*

Goals of schooling typically include an emphasis on the development of high self-esteem and positive attitudes in students. Measures of self-concept and attitudes are often, therefore, used as outcome measures in studies of schooling even though it is not possible to disentangle which comes first – for example, do positive attitudes lead to higher achievement, or does higher achievement lead to positive attitudes? Most likely the influence goes both ways. Regardless of what leads to what, it is important for policy makers to know if students in their country have low self-concepts or negative attitudes towards their schooling or towards studying. To some extent attitudes are malleable and, therefore, could be responsive to changes in aspects of school programs. The inclusion in PISA of affective measures such as attitudes towards school and studying and attitudes towards and engagement with reading enables countries to assess their standing on these variables relative to other PISA participants.

Australian and international results on a selection of these kinds of variables are presented and discussed in this chapter in terms of mean scores. Detail on the content of the scales is provided in Appendix 4. Only 21 OECD countries, including Australia, took part in the cross-curricular competencies option, which included measures of learning attitudes and strategies and only 16 OECD countries, including Australia, took part in the IT familiarity option. The four non-OECD countries undertook both of these options. Of the English speaking countries, Canada and the United Kingdom did not participate in the measurement of learning attitudes and strategies and the United Kingdom did not administer the IT familiarity component.

Metric for reporting results

The variables discussed here were all derived from students' responses to sets of related questions in the Student Questionnaire. Each of the variables takes the form of an index, standardised to a mean of zero and a standard deviation of one.[5] Values below zero on an index do not necessarily imply that students answered the set of questions negatively. Rather, a negative value shows that a country's students answered less positively, on average, than other countries' students did. Similarly, values above zero indicate that students in those countries answered more positively than the total OECD sample did, on average. As with the achievement results

[5] Data in this form are particularly useful in multivariate analyses, many of which have been carried out in PISA. Some Australian analyses of this nature are included in Chapters 7 and 8. For readers interested in technical aspects, each index was calculated as a weighted maximum likelihood estimate from a one-parameter item response model. A sample of 500 students from each OECD country was used for this step and for the standardisation. The indices were then validated both within and across countries using structural equation modelling.

presented earlier in this chapter, there is a zone on either side of the OECD average (which, for the questionnaire variables, is either side of zero) within which countries' results are not significantly different from the overall OECD result.

Engagement in reading

Australia's mean on the *engagement in reading* index was -0.07, with a standard deviation of 1.00. This result was not significantly different from the OECD average. Many of the within-country results on this index were bunched towards the middle of the distribution of means, so that only seven countries' results were better than and six countries' results lower than the OECD average. A handful of countries had fairly extreme values: Portugal's and Mexico's means were about a third of a standard deviation above the OECD average, while Norway, Belgium and The Netherlands, with means about a quarter of a standard deviation below the OECD average, achieved the lowest results on engagement in reading. Females were significantly more engaged in reading than males in every PISA country. The smallest gender gap was found in Korea (a difference of about a quarter of a standard deviation) and the largest, almost a standard deviation in magnitude, were found in Switzerland and Finland. The gender difference in Australia was about half a standard deviation. The full set of results on this index is included in Appendix 3 (Table A3.16).

Australian students were at the same level as the OECD average in their engagement with reading.

While engagement in reading was correlated with reading literacy achievement in all countries, the country averages on the index bore little relationship to country average performance. Of the highest-achieving countries in reading, only Finland had an above average result on engagement in reading. English speaking countries either had mean results on this variable that were equivalent to or below the OECD average. Multiple comparisons, such as have been reported for the reading achievement results earlier in the chapter, showed that eight countries, mostly European, had significantly higher engagement in reading scores than Australia and eight countries, including Ireland, the United Kingdom, the United States, Norway and Belgium, had significantly lower scores.

Engagement in reading was correlated with reading literacy achievement in all countries (but only weakly).

Comfort and perceived ability with computers

There was a much wider range of country scores on the index of *comfort and perceived ability with computers* than on the engagement in reading index. Only Denmark's and Norway's mean results did not differ from the OECD average. The country where the students said they were most comfortable with using computers was the United States (mean = 0.62), and the country where they said they were least comfortable was Brazil (mean = -0.50). The United States' result was significantly higher than all others and the opposite was the case for Brazil. Australia's result (mean = 0.44) was one of the highest. The five countries where the students were most comfortable with using computers – the United States, Canada, Australia, New Zealand and Belgium – were the only countries to achieve a positive mean score on this index. These five countries each achieved a significantly higher mean result on the index than all the other countries below them, except that

Australian students reported a relatively high level of comfort and ability with using computers.

Canada's and Australia's results were equivalent. Korea and Japan, countries whose students could also be expected to feel comfortable with using computers, did not administer this part of the questionnaire.

For Australia, the international report indicates a statistically significant relationship between the comfort and perceived ability with computers index and reading achievement, though it made little difference whether the students were in the third or top quarter of the computer comfort index for their country (see Table A3.17 in Appendix 3). In many countries the comfort/perceived ability index was not correlated with reading achievement (Finland, Luxembourg and Norway, for example, as can also be seen in Table A3.17). Nor was there any obvious relationship between countries' relative achievement in reading and their relative results on the comfort/perceived ability index. Finland's mean result on this index was below the OECD average, yet Finland was the highest achiever in reading literacy. Mexico, one of the two lowest countries in reading achievement, had significantly higher mean results on the comfort/perceived ability with computers index than Germany, the Czech Republic and Hungary, among OECD countries, and also than the Russian Federation and Brazil.

Within-country breakdowns by gender are included in the international results shown in Table A3.17. The gender differences are not as consistent as those for engagement in reading. In New Zealand, Mexico and Ireland the gender differences were not significant while in the Russian Federation and the United States they barely reached statistical significance. The largest difference from the OECD average was for males in the United States (0.70), closely followed by Canada (0.67). Females in the United States (0.54) were about as far above the OECD average (-0.19) as their counterparts in several countries, most noticeably Brazil (-0.62), Germany (-0.53) and Liechtenstein (-0.52), were below it. In Australia, as in the United States, Canada and New Zealand, both females and males were well above the OECD country average in comfort/ability with computers, even though New Zealand was the only one of these where the results by gender were equivalent. The gender gap in Australia (0.26, or a quarter of a standard deviation) was one of the lowest internationally.

Australian males reported significantly higher comfort in using computers than females, but the difference was smaller than in most countries.

Self-rated comfort/ability with computers would be expected to be related to availability of computers and extent of experience in using them. In turn, availability would be expected to be related to home background and also to country affluence and with how education dollars are spent. Per capita GDP data by country included in the PISA international report (OECD, 2001) show Luxembourg at the top of the table, followed by the United States, Switzerland and Iceland. Next are several countries bunched closely together, mostly European but including Canada and Australia. New Zealand's GDP is at the same level as Italy's and Spain's, at about 75 per cent of the level of Australia's and Canada's and only a little over half of the United States'. Comparing these data with PISA's information on computer comfort suggests that education policy plays a role over and above country affluence in students' exposure to computers and the students' perceived level of ability in using them.

PISA results suggest that education policy plays a role in students' exposure to computers.

In Australia, the comfort/ability with computers index was correlated at about 0.5 with computer usage and experience. Having one or more computers at home helped, but use of computers at school as well as at home was more highly correlated with the comfort/ability index than merely having one at home was. Provision of computers in schools and ensuring that there are opportunities for students to use them appear to be areas warranting continued attention by policy makers.

Interest in computers

An index of interest in computers is included in the PISA database. This index was neither related to reading achievement across the OECD, nor in individual countries except possibly the Russian Federation. The index was constructed from four questions each calling for Yes/No answers, and is of limited analytical use because, as shown in the international report, the top quarter of students on the index in all countries achieved the maximum possible score on it. However, as expected, males were generally more interested in computers than females, except in Brazil, Ireland, Latvia, the Russian Federation and the United States, where males and females showed the same level of interest. The largest gender gap (0.84) was found in Denmark. In Australia the students' levels of interest in computers were below the OECD averages by gender, by about the same amount for males and females, and the gender gap (0.37) was equivalent to the OECD average difference (0.34).

Learning strategies

Three kinds of learning strategies were measured in the self-regulated learning component of the cross-curricular competencies included in PISA. In terms of relationships with reading achievement, the most important of these is the extent to which students use *control strategies* in their learning – such as testing themselves on what they have learned, sorting out which concepts they have not fully understood and giving priority to the most important things they need to learn. The second most important in relation to within-country reading achievement encompasses *elaboration strategies*, such as trying to relate new material to knowledge from other subjects, using existing knowledge in a subject to help in understanding further information, and thinking about how the information might be useful in practice. Least related to reading achievement, both within and across countries, is the use of *memorisation strategies*, for which no association with achievement was found in more than half the countries. In Australia the correlations with reading achievement of the three learning strategy variables were 0.24 (control), 0.12 (elaboration) and 0.09 (memorisation) – all weak but significantly different from zero.

Australian and international results on the learning strategy scales are summarised in the following paragraphs.

Control strategies

Australia's mean on the control strategies index (0.02) was at the OECD average. Highest on this index was Austria (0.40), with a significant gap then to the next highest, the Czech Republic (0.27). Furthest below average was Norway, with a mean of -0.58, followed by Finland (-0.47) and Korea (-0.44). On average across

Female students studied in a more controlled way than male students in most countries, including Australia.

the OECD countries, females rated themselves as using control strategies more than males did, though in some countries, including Denmark, Iceland, Korea, Sweden and The Netherlands, there was no gender difference on this variable.

Elaboration strategies

Even though there was a significant, though weak, positive relationship within most countries between reading achievement and use of elaboration strategies in learning, countries are ordered very differently by their mean results on this index compared with their order on reading achievement. Brazil and Mexico, the lowest achievers in reading, are higher than any other country in use of elaboration strategies in learning, while Finland, the highest achiever in reading, is significantly below average on this index. The countries where students reported the lowest use of elaboration strategies were Iceland (mean = -0.24) and Norway (-0.22). Brazil's mean was 0.47 and Mexico's 0.33. Australia's result, at 0.07, was significantly above the OECD average, but only by a small amount. Altogether 10 countries were above the OECD value and nine below it. Within-country gender differences were notable by their absence on this index, except in Austria, Belgium, The Netherlands and the four Scandinavian countries, in all of which males reported using elaboration strategies more than females did. The gender gap was largest (0.44) in Norway.

Memorisation strategies

Consistent with the strength of belief held by Australian students in TIMSS that memorising notes is important for success in mathematics and science, even at upper secondary level (Lokan & Greenwood, 2001), it is not surprising that Australia's result on the memorisation strategies index in PISA (0.14) was significantly above the OECD average. Six countries: Austria, Denmark, Germany, Portugal, Switzerland and The Netherlands, had results equivalent to the OECD average on this index. There were some very extreme results, especially in Hungary which attained a mean score of 0.89, close to one standard deviation above the OECD country average. The next highest means were found in the Russian Federation (0.36) and Ireland (0.27). At the other extreme, with very low reported use of memorisation strategies, were Italy (mean = -0.69) and Norway (-0.60).
Gender differences, where they occurred, were in favour of females, except in Norway. In more than half the countries, including Australia, the males' and females' mean results were not significantly different. The largest gender difference, 0.40, occurred in Luxembourg.

>> *Summary*

This chapter presents international results, viewed from Australia's perspective, on the PISA scales of reading, mathematical and scientific literacy. Within reading literacy, the major assessment domain for PISA 2000, results are reported in the three reading process areas of 'retrieving information', 'interpreting texts' and 'reflecting on and evaluating texts'. International results on some of the cross-curricular competencies assessed in PISA are also presented, as these competencies are relevant to adult life and several are commonly included in statements about the goals of schooling.

The main results discussed are in the form of charts showing means and distributions of performance, together with standard error terms as an indication of the precision with which the means were estimated in each country. The international achievement results in each of the three domains were scaled to a mean of 500 and a standard deviation of 100. The means on the reading sub-scales were determined in relation to the mean for all reading items combined, and vary slightly from 500 (498 for retrieving information, with standard deviation 111; 501 for interpreting texts, with standard deviation 100; and 502 for reflecting/evaluating, with standard deviation 106).

Multiple comparisons of results within the full set of participating countries (except for The Netherlands, which was unable to meet the sampling criteria) are considered with Australia as the focal country. These show very few countries achieving superior results to Australia's, taking statistical significance into account.

In summary, Australia's mean scores on all of the reading, mathematical and scientific literacy scales were significantly above the OECD averages. Only one country outperformed Australia in reading literacy overall and on the reading sub-scales. For the total reading measure and the retrieving information and interpreting texts sub-scales, it was Finland that performed better than Australia and for the reflecting/evaluating sub-scale it was Canada. Australia's results were significantly higher than the results of 21 to 23 countries, depending on the aspect of reading being analysed. For some countries there was some variation in performance across the reading processes, but Australia's results – means of 526 for reflecting/evaluating, 527 for interpreting texts and 536 for retrieving information – were among the most consistent.

Australia's means were 533 on the PISA mathematical literacy scale and 528 on the PISA scientific literacy scale. Only one country, Japan, achieved a significantly higher mean mathematics score than Australia, while Korea joined Japan in performing significantly better than Australia in science.

On the cross-curricular measures discussed in this chapter, Australian students were well above the OECD average in self-rated comfort/perceived ability with computers but were below average in their level of interest in computers. Australian students reported an average level of use of control strategies in learning, a slightly above average level of use of elaboration strategies and a slightly more above average level of use of memorisation strategies. Even though the latter variable showed a small positive correlation with reading achievement in Australia, students' reliance on memorisation is of concern in light of the Australian Population 3 TIMSS results. In TIMSS, belief in the importance of memorising notes was negatively related to achievement over and above many other variables, especially in advanced mathematics and physics (Lokan & Greenwood, 2001).

Gender differences were found in all countries in all aspects of reading, including engagement with reading, with females outscoring males in every case. The gender gap in reading in Australia, about a third of a standard deviation, was the same as the gap for the OECD as a whole. While Australia is not out of step with the OECD in this regard, it would be preferable to be ahead in raising the level of males' reading literacy performance. Success in most of life's pursuits depends on being able to read, and to interpret and respond appropriately to what has been read. The importance of good reading skills cannot be overestimated. In mathematics and science, Australian males and females scored at equivalent levels, but there were gender differences in 15 countries in mathematics, all in favour of males, and in six countries in science, half favouring males and half, females.

Results by gender on the interest in computers and the comfort/perceived ability with computers scales were either not significantly different (in a small number of countries), or favoured males, as was the case in Australia. Gender results on the learning strategies indices were mixed.

Comparisons of distributions of results are made in the chapter. Generally the Australian distributions were equivalent to or narrower than the distributions for the OECD as a whole – for example, in the range of scale scores spanned by the middle half, the middle 80 per cent or the middle 90 per cent of students in each achievement domain. An exception was in interpreting texts, where the Australian results for the middle half of the distribution showed greater spread than the OECD average spread. For mathematics and science, Australia's distributions were narrower than the OECD average distributions.

The highest performing five per cent of students per country were either surpassed or equalled by the highest performing Australian students in each of the main domains and in the reading processes. Smaller differences in performance were found between Australian students at the 5th and 25th percentiles (that is, towards the low end of the distribution in each case) than in the corresponding group in the OECD as a whole on all PISA measures except the interpreting texts sub-scale. The smaller than average differences in most areas suggest that some progress has been made in raising the performance of our lowest achieving students. More assistance is needed in helping this group of Australian students to improve their skills still further, especially in interpreting texts.

Ideally, education systems aim to have their best students performing at high levels and to minimise the gap between their lowest and highest performers. PISA results show that Australia is succeeding with its top students, and, except for interpreting texts in reading, has average or less than average spread of results across the whole student cohort. The results achieved by Korea, however, show that a much higher degree of equality of outcomes is attainable.

Chapter **THREE**

ADDING MEANING TO PISA RESULTS: PROFILES OF STUDENTS' SKILLS IN READING

PISA's coverage of reading literacy

We have seen in Chapter 2 that PISA results in reading literacy are reported on three reading process sub-scales as well as on a combination of all the reading items. There is a 'retrieving information' sub-scale, based on students' ability to locate information in text; an 'interpreting texts' sub-scale, based on ability to construct meaning and draw inferences from what has been read; and a 'reflecting on and evaluating texts' sub-scale, based on students' ability to relate what they have read to their knowledge, ideas and experiences. Scores on the sub-scales represent degrees of proficiency in each of these aspects of reading literacy.

PISA reading literacy results are reported on three sub-scales: 'retrieving information', 'interpreting texts' and 'reflecting on and evaluating texts', and on the total scale.

In the view of the experts who developed the PISA assessment framework for reading literacy – as recommended to, discussed and ratified by the Board of Participating Countries (see Appendix 1) – the three reading processes mentioned above together comprise the most important dimension of the framework. One of PISA's key objectives is to monitor trends in performance over time, and reading processes are the framework aspect on which it makes most sense to look for change. Other aspects included in the framework are text structure (whether the stimulus text for a task is continuous or non-continuous), text type (for example, whether the text is expository or narrative), and context. The distributions of the 141 PISA reading items across the framework categories are shown in Table 3.1. In the table, the elements under each heading are listed alphabetically to be consistent with the international report.

A key objective of PISA is to monitor trends in performance over time.

Table 3.1 Classification of Assessment Items for the Combined Reading Literacy Scale

	Number of items					
	Multiple choice items	Complex multiple choice items	Closed constructed responses	Open constructed responses	Short responses	Total
Distributions of reading items by text structure						
Continuous	42	3	3	34	7	89
Non-continuous	14	4	12	9	13	52
Total	**56**	**7**	**15**	**43**	**20**	**141**
Distributions of reading items by reading process						
Interpreting	43	3	5	14	5	70
Reflecting	3	2	-	23	1	29
Retrieving Information	10	2	10	6	14	42
Total	**56**	**7**	**15**	**43**	**20**	**141**
Distributions of reading items by text type						
Argumentative/Persuas.	7	1	2	8	-	18
Descriptive	7	1	-	4	1	13
Expository	17	1	-	9	4	31
Injunctive	3	-	1	5	-	9
Narrative	8	-	-	8	2	18
Advertisements	-	-	-	1	3	4
Charts/Graphs	8	-	2	3	3	16
Forms	1	1	4	1	1	8
Maps	1	-	-	1	2	4
Schematics	2	2	-	-	1	5
Tables	2	1	6	3	3	15
Total	**56**	**7**	**15**	**43**	**20**	**141**
Distributions of reading items by context						
Educational	22	4	1	4	8	39
Occupational	4	1	4	9	4	22
Personal	10	-	3	10	3	26
Public	20	2	7	20	5	54
Total	**56**	**7**	**15**	**43**	**20**	**141**

The framework categories were assessed through a range of item types. Some items were multiple choice; some were 'complex multiple choice' (mostly requiring a series of True/False or Yes/No answers within the item); some, referred to as 'closed constructed response', required a clear-cut short answer to be supplied; some, referred to as 'short response', required a short answer that was not so clear-cut; and some, referred to as 'open constructed response, required an extended answer to be written. The distribution of item types is also shown in Table 3.1, cross-tabulated with the framework categories.

Several kinds of assessment task were used.

>> *PISA's 'described proficiency scales' for reading literacy*

As a convenient and informative way to describe increasing proficiency in the three reading literacy aspects, each sub-scale has been divided into five levels, based on the types of knowledge and skills required to answer the assessment items at each level. Students 'at' a particular level of proficiency are typically able to demonstrate the knowledge and skills associated with that level, and also typically possess the knowledge and skills defined as applying at lower proficiency levels. The described proficiency scales, which were constructed using Item Response Theory techniques, not only allow each student to be located at a level on each aspect, but also allow the reading tasks to be allocated to appropriate levels according to their difficulty.

An important feature of PISA is the way that students' results are described in terms of skills at five levels of proficiency.

Cut-off scores on the PISA reading literacy scales were set internationally to define the five levels, with Level 5 being highest. A score of more than 625 defines Level 5, scores in the range 553 to 625 define Level 4, scores between 481 and 552 define Level 3, scores between 408 and 480 define Level 2 and the upper boundary of Level 1 is 407. It was necessary also to set a lower boundary for Level 1 (335), given that the range of reading task difficulties in PISA does not allow skills relating to scores below 335 to be described. Students performing below this level should not be assumed to have no reading literacy skills at all, but scores in this region do point to serious deficiencies in students' capacity for life-long learning and functioning in other areas of society in their life beyond school.

A combination of expert judgement of the skills required to answer each reading task and statistical analysis of the student data was used to determine the cut-off scores. Tasks with difficulties locating them within each proficiency level were judged by subject matter experts to share similar features and requirements and to differ in recognisable ways from tasks at other levels. In statistical terms, the cut-offs were then set so that approximately equal changes in task difficulty were represented in each level and so that all students within a level could be expected to answer at least half of the items at that level correctly. Students just below the top of a level would be expected to get fewer than half of the items at the next level correct. The difficulty range spanned by each level is such that students at the top of a level have a 62 per cent chance of answering the hardest items from the level correctly and a 78 per cent chance of answering the easiest items correctly. On average, these students would be expected to provide correct answers to about 70 per cent of the items at that level correctly. Students at the bottom of a level, those who are expected to answer half of the items at the level correctly, have a 62 per cent chance of success on the easiest items and a 42 per cent chance of success on the hardest items from that level.

The proficiency levels were defined using a combination of expert judgement and the PISA assessment results.

Descriptions of the knowledge and skills required of students at each proficiency level are displayed in Figure 3.1. The descriptions reflect the skills assessed by the full range of PISA reading literacy items. The figure also provides definitions of the sub-scales and an analysis of what makes assessment tasks in each sub-scale easier or harder. To help with understanding of the proficiency descriptions and levels, several examples of PISA reading literacy items are given immediately following the figure.

	Retrieving information	Interpreting	Reflecting/evaluating
What is being assessed on each of the reading literacy scales:			
	Retrieving information is defined as locating one or more pieces of information in a text.	Interpreting is defined as constructing meaning and drawing inferences from one or more parts of a text.	Reflecting/evaluating is defined as relating a text to one's experience, knowledge and ideas.
Characteristics of the task associated with increasing difficulty on each of the reading literacy scales:			
	Task difficulty depends on the number of pieces of information that need to be located. Difficulty also depends on the number of conditions that must be met to locate the requested information, and on whether what is retrieved needs to be sequenced in a particular way. Difficulty also depends on the prominence of information, and the familiarity of the context. Other relevant characteristics are the complexity of the text, and the presence and strength of competing information.	Task difficulty depends on the type of interpretation required, with the easiest tasks requiring identifying the main idea in a text, more difficult tasks requiring understanding relationships that are part of the text, and the most difficult requiring either an understanding of the meaning of language in context, or analogical reasoning. Difficulty also depends on how explicitly the text provides the ideas or information the reader needs in order to complete the task; on how prominent the required information is, and on how much competing information is present. Finally, the length and complexity of the text and the familiarity of its content affect difficulty.	Task difficulty depends on the type of reflection required, with the easiest tasks requiring simple connections or explanations relating the text to external experience, and the more difficult requiring an hypothesis or evaluation. Difficulty also depends on the familiarity of the knowledge that must be drawn on from outside the text; on the complexity of the text; on the level of textual understanding demanded; and on how explicitly the reader is directed to relevant factors in both the task and the text.
Level			
5	Locate and possibly sequence or combine multiple pieces of deeply embedded information, some of which may be outside the main body of the text. Infer which information in the text is relevant. Deal with highly plausible and/or extensive competing information.	Either construe the meaning of nuanced language or demonstrate a full and detailed understanding of text.	Critically evaluate or hypothesise, drawing on specialised knowledge. Deal with concepts that are contrary to expectations and draw on a deep understanding of long or complex texts.
4	Locate and possibly sequence or combine multiple pieces of embedded information, each of which may need to meet multiple criteria, in a text with unfamiliar context or form. Infer which information in the text is relevant to the task.	Use a high level of text-based inference to understand and apply categories in an unfamiliar context, and to construe the meaning of a section of text by taking into account the text as a whole. Deal with ambiguities, ideas that are contrary to expectation and ideas that are negatively worded.	Use formal or public knowledge to hypothesise about or critically evaluate a text. Show accurate understanding of long or complex texts.
3	Locate, and in some cases recognise the relationship between, pieces of information, each of which may need to meet multiple criteria. Deal with prominent competing information.	Integrate several parts of a text in order to identify a main idea, understand a relationship or construe the meaning of a word or phrase. Compare, contrast or categorise taking many criteria into account. Deal with competing information.	Make connections or comparisons, give explanations, or evaluate a feature of text. Demonstrate a detailed understanding of the text in relation to familiar, everyday knowledge, or draw on less common knowledge.
2	Locate one or more pieces of information, each of which may be required to meet multiple criteria. Deal with competing information.	Identify the main idea in a text, understand relationships, form or apply simple categories, or construe meaning within a limited part of the text when the information is not prominent and low-level inferences are required.	Make a comparison or connections between the text and outside knowledge, or explain a feature of the text by drawing on personal experience and attitudes.
1	Take account of a single criterion to locate one or more independent pieces of explicitly stated information.	Recognise the main theme or author's purpose in a text about a familiar topic, when the required information in the text is prominent.	Make a simple connection between information in the text and common, everyday knowledge.

Figure 3.1 Description of What is Being Measured at Each Level of the Reading Literacy Sub-scales

Sample items

The sample reading items included here are part of a limited set of items from PISA 2000 that have been released for public use.[1] The majority of the items are being kept secure for use in later cycles, to link the assessments so that trends can be measured. The items shown here were chosen to illustrate the three reading processes, a range of proficiency levels and a range of text and item types. From the items it is easy to see that tasks at the higher end of the scale require very different skills from those at the lower end. For example, while all tasks on the retrieving information sub-scale require information to be located, whether in diagrams, prose or other types of text, tasks become more difficult as the information becomes more embedded, needs to satisfy more criteria, and so on.

On all the sub-scales, tasks vary in difficulty according to the reading strategies asked for in the items themselves, how complex and unfamiliar the text is and how much competing or distracting information is present in the text. It is useful to keep these parameters in mind when looking at the sample items. Items from five of the units are shown here, sometimes with just an extract of the stimulus text. A table of results for Australia and some other countries on the illustrated items is provided following the presentation of the items. Unless otherwise stated, comments in the text below about the difficulty or easiness of the items apply to the average over the OECD as a whole.[2]

Samples of assessment tasks and items are included here to illustrate the variety of tasks and the scope of PISA's reading literacy domain.

[1] All items in the released set can be accessed on the OECD's PISA website (www.pisa.oecd.org).
[2] References to the 'OECD as a whole' mean the 28 OECD member countries that took part in PISA (see Chapter 1).

Items relating to the following text were among the easiest overall in the test. 'Runners', in the international title, was changed to 'Running Shoes' in Australia.

FEEL GOOD IN YOUR RUNNING SHOES

For 14 years the Sports Medicine Centre of Lyon (France) has been studying the injuries of young sports players and sports professionals. The study has established that the best course is prevention … and good shoes.

Knocks, falls, wear and tear...

Eighteen per cent of sports players aged 8 to 12 already have heel injuries. The cartilage of a footballer's ankle does not respond well to shocks, and 25% of professionals have discovered for themselves that it is an especially weak point. The cartilage of the delicate knee joint can also be irreparably damaged and if care is not taken right from childhood (10–12 years of age), this can cause premature osteoarthritis. The hip does not escape damage either and, particularly when tired, players run the risk of fractures as a result of falls or collisions.

According to the study, footballers who have been playing for more than ten years have bony outgrowths either on the tibia or on the heel. This is what is known as "footballer's foot", a deformity caused by shoes with soles and ankle parts that are too flexible.

Protect, support, stabilise, absorb

If a shoe is too rigid, it restricts movement. If it is too flexible, it increases the risk of injuries and sprains. A good sports shoe should meet four criteria:

Firstly, it must *provide exterior protection*: resisting knocks from the ball or another player, coping with unevenness in the ground, and keeping the foot warm and dry even when it is freezing cold and raining.

It must *support the foot*, and in particular the ankle joint, to avoid sprains, swelling and other problems, which may even affect the knee.

It must also provide players with good *stability* so that they do not slip on a wet ground or skid on a surface that is too dry.

Finally, it must *absorb shocks*, especially those suffered by volleyball and basketball players who are constantly jumping.

Dry feet

To avoid minor but painful conditions such as blisters or even splits or athlete's foot (fungal infections), the shoe must allow evaporation of perspiration and must prevent outside dampness from getting in. The ideal material for this is leather, which can be water-proofed to prevent the shoe from getting soaked the first time it rains.

All of the questions relating to 'Running Shoes' are at Level 1. The first, shown below, requires interpretation, but is easy because the point is made prominently near the beginning of the text.

Running Shoes Question 1

What does the author intend to show in this text?

A That the quality of many sports shoes has greatly improved.
B That it is best not to play football if you are under 12 years of age.
C That young people are suffering more and more injuries due to their poor physical condition.
D That it is very important for young sports players to wear good sports shoes.

The second question asks for a single piece of information directly stated in the text to be located and written out. A further factor making the item relatively easy is that the information is at the beginning of a new section of text, though other information, which the second response shown below has been attracted to, is present in the rest of the section. Only the first answer shown here is correct.

Running Shoes Question 2

According to the article, why should sports shoes not be too rigid?

IT restricts movement

According to the article, why should sports shoes not be too rigid?

So they can take some impact

The next item also asks for information to be located and written out. The item is a little more difficult because four pieces of information have to be correctly stated to gain a correct score. The students also have to filter out competing information. The marking criteria for this item are included here following the sample responses to illustrate the nature of the Marking Guide. Again, the first answer shown below is correct and the second one incorrect.

Running Shoes Question 3

One part of the article says, "A good sports shoe should meet four criteria."

What are these criteria?

- Provide exterior protection
- support the foot
- stability
- absorb shocks

One part of the article says, "A good sports shoe should meet four criteria."

What are these criteria?

the shoe should take impact

should be not to rigid.

should allow evaporation.

prevent dampness from getting in.

Extract from Marking Guide:

FULL CREDIT

Score 1: Responses which refer to the four criteria in italics in the text. Each reference may be a direct quotation, a paraphrase or an elaboration of the criterion. Criteria may be given in any order. The four criteria are:

(1) To provide exterior protection
(2) To support the foot
(3) To provide good stability
(4) To absorb shocks.

For example:

- **1** Exterior protection
  2 Support of the foot
  3 Good stability
  4 Shock absorption
- It must provide exterior protection, support the foot, provide the player with good stability and must absorb shocks.
- **1** They have to keep you from skidding and slipping. *[stability]*
  2 They have to protect your foot from shock (*e.g.* jumping). *[absorb shocks]*
  3 They have to protect you from bumpy ground and from the cold. *[exterior protection]*
  4 They have to support your foot and ankle. *[support foot]*
- Protect, support, stabilise, absorb *[Quotes sub-heading of this section of text.]*

NO CREDIT

Score 0: Other responses. For example:

1. Protect against knocks from the ball or feet.
2. Cope with unevenness in the ground.
3. Keep the foot warm and dry.
4. Support the foot.

Note that in the second response to Question 3 the student picked up some of the incorrect information flagged in the Marking Guide. This error was not uncommon.

The final item about running shoes requires students to reflect on the logical connection between two parts of a sentence, which are clearly indicated in the test item.

Running Shoes Question 4

Look at this sentence from near the end of the article. It is presented here in two parts:

"To avoid minor but painful conditions such as blisters or even splits or athlete's foot (fungal infections),…" *(first part)*

"…the shoe must allow evaporation of perspiration and must prevent outside dampness from getting in." *(second part)*

What is the relationship between the first and second parts of the sentence?

The second part

A contradicts the first part.

B repeats the first part.

C illustrates the problem described in the first part.

D gives the solution to the problem described in the first part.

LAKE CHAD

The stimulus for 'Lake Chad' was presented graphically, with a minimum of text. Students needed to have a basic understanding of how information is shown in this form, and to be able to read line graphs. Items in this unit are at levels ranging from 1 to 4, and involve all three reading processes.

LAKE CHAD

Figure 1 shows changing levels of Lake Chad, in Saharan North Africa. Lake Chad disappeared completely in about 20,000 BC, during the last Ice Age. In about 11,000 BC it reappeared. Today, its level is about the same as it was in AD 1000.

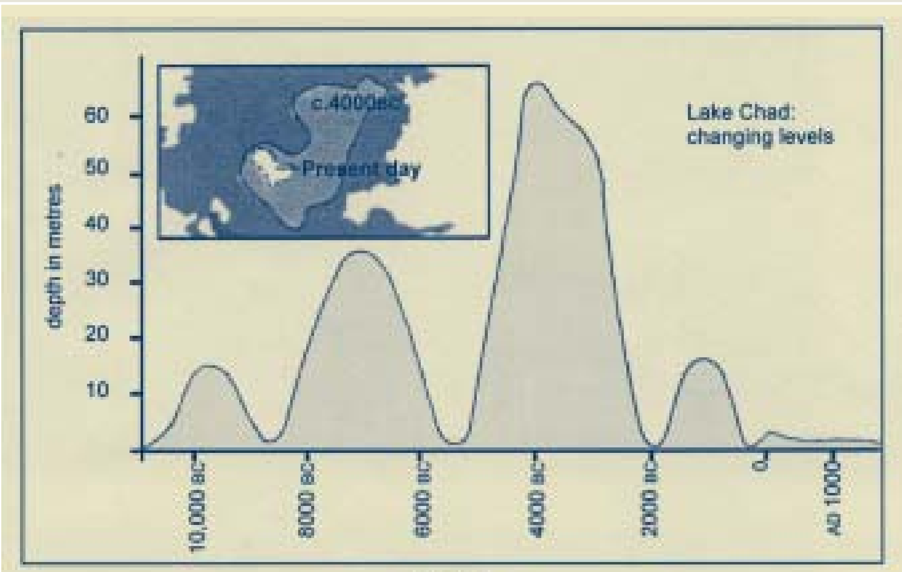


Figure 1

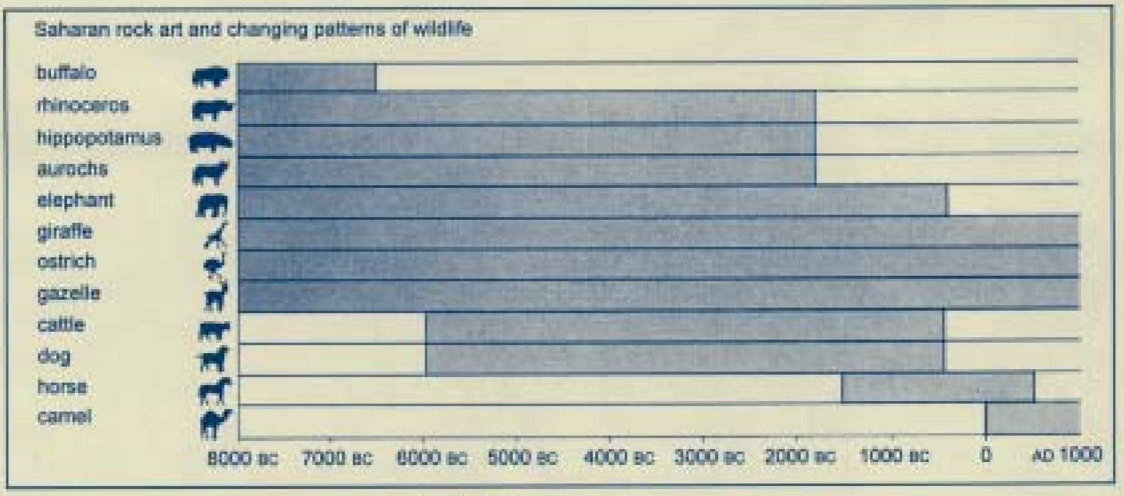


Figure 2

The first two items require retrieval of information, but are beyond Level 1 because of the added need to be able to locate information presented graphically. The first item, a multiple choice item (not shown) asks for the depth of Lake Chad today. That item is at Level 2. The second item also asks for some information from the graph, but is harder because some estimation is needed, the required value is not marked, and extra care is needed because the dates are in the negative direction for 'BC'. Many students wrote 10 000 as their answer, failing to extrapolate from the scale. The response below was assessed as correct – answers between 10 500 and 12 000 BC were accepted.

Lake Chad Question 2

In about which year does the graph in Figure 1 start?

11,000 BC

The next question is a 'short response' item, requiring students to evaluate what they have read and make an inference about the author's intention in preparing the graph. This is a Level 4 item. It is more difficult because of the level of reasoning that needs to be invoked. Students with the necessary skill could state the answer correctly and succinctly:

Lake Chad Question 3

Why has the author chosen to start the graph at this point?

Because 11,000 BC is when it reappeared

but sometimes made spelling mistakes. Answers with mistakes in grammar and/or spelling were not penalised as long as the correct point was made. The following answer was marked correct:

> because before than it disapeared completly and at that time it reapeared

A common mistake was to ignore the information at the head of the stimulus when interpreting the graph:

> Why has the author chosen to start the graph at this point?
>
> it is probably as far back as the information goes

The final two items in the Lake Chad unit are multiple choice, both requiring interpretation skills. One (not shown) is a Level 1 item asking for the reason these particular animals were chosen for illustration. The other is a Level 3 item, shown below. This item is harder because it requires consideration of both figures.

Lake Chad Question 5

For this question you need to draw together information from Figure 1 and Figure 2.

The disappearance of the rhinoceros, hippopotamus and aurochs from Saharan rock art happened

A at the beginning of the most recent Ice Age.

B in the middle of the period when Lake Chad was at its highest level.

C after the level of Lake Chad had been falling for over a thousand years.

D at the beginning of an uninterrupted dry period.

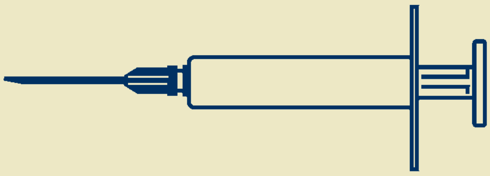
FLU

All three reading processes are also assessed in 'Flu', the stimulus for which follows.

ACOL VOLUNTARY FLU IMMUNISATION PROGRAM

As you are no doubt aware, the flu can strike rapidly and extensively during winter. It can leave its victims ill for weeks.

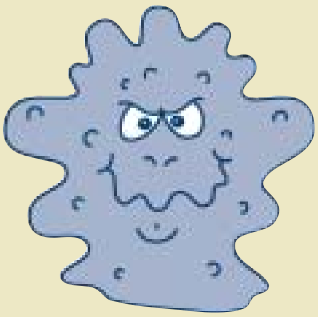
The best way to fight the virus is to have a fit and healthy body. Daily exercise and a diet including plenty of fruit and vegetables are highly recommended to assist the immune system to fight this invading virus.



ACOL has decided to offer staff the opportunity to be immunised against the flu as an additional way to prevent this insidious virus from spreading amongst us. ACOL has arranged for a nurse to administer the immunisations at ACOL, during a half-day session in work hours in the week of May 15. This program is free and available to all members of staff.

Participation is voluntary. Staff taking up the option will be asked to sign a consent form indicating that they do not have any allergies, and they understand they may experience minor side effects.

Medical advice indicates that the immunisation does not produce influenza. However, it may cause some side effects such as fatigue, mild fever and tenderness of the arm.



WHO SHOULD BE IMMUNISED?

Anyone interested in being protected against the virus.

This immunisation is especially recommended for people over the age of 65. But regardless of age, it is for ANYONE who has a chronic debilitating disease, especially cardiac, pulmonary, bronchial or diabetic conditions.

In an office environment ALL staff are at risk of catching the flu.

WHO SHOULD NOT BE IMMUNISED?

Individuals hypersensitive to eggs, people suffering from an acute feverish illness and pregnant women.

Check with your doctor if you are taking any medication or have had a previous reaction to a flu injection.

If you would like to be immunised in the week of May 15 please advise the personnel officer, Fiona McSweeney, by Friday May 5. The date and time will be set according to the availability of the nurse, the number of participants and the time convenient for most staff. If you would like to be immunised for this winter but cannot attend at the arranged time please let Fiona know. An alternative session may be arranged if there are sufficient numbers.

For further information please contact Fiona on ext. 5577.

Enjoy
Good Health

The first question is a multiple choice question, requiring careful reading to locate the correct piece of directly stated information in the presence of competing information. This item is at Level 2.

Flu Question 1

Which one of the following describes a feature of the ACOL flu immunisation program?

A Daily exercise classes will be run during the winter.
B Immunisations will be given during working hours.
C A small bonus will be offered to participants.
D A doctor will give the injections.

The second question requires reflecting about what has been read to understand the way the author used a style encouraging people in her workplace to be immunised. The item is worth two marks if fully correct, one mark if partly correct. For full credit, the answer needs to refer accurately to the text and to relate style to purpose. To do this, it can refer to one or more of the features in detail (for example, layout, writing style, graphics, and so on) and it needs to bring in evaluative terms other than just 'friendly' and 'encouraging'. To earn a partial score, or 'partial credit', the response refers accurately to the text but relates purpose to content rather than to style, or merely repeats 'friendly' and/or 'encouraging'. Vague or inaccurate responses, or responses that give an irrelevant or implausible answer are not awarded any marks. Examples of responses at each score level are shown below – two responses that each earned a score of 2, one that earned a score of 1 and one that scored zero. Scores of both 1 and 2 were placed at Level 3, though one is near the bottom and one near the top of this range.

Flu Question 2

Score 2

We can talk about the **content** of a piece of writing (what it says).

We can talk about its **style** (the way it is presented).

Fiona wanted the **style** of this information sheet to be friendly and encouraging.

Do you think she succeeded?

Explain your answer by referring in detail to the layout, style of writing, pictures or other graphics.

It is very clear and effective and it catches your eye when you see the picture of the germ and the needle.

NO IT LOOKS SCARY WITH THE BIG NEEDLE AND THAT MONSTER

Score 1

I think there was a friendly approach to this letter by telling people look we'll do this for you if you want it's your choice

Score 0

Correct Fiona McSweeney wanted a friendly & encouraging info sheet as the more people immunised the healthy the people at work are

The third question in the unit (not shown) is a multiple choice question, also at Level 3, requiring interpretation of information in the text about a flu injection being a good idea, but not a substitute for exercise and a healthy diet.

The fourth item asks students to explain whether part of the text is misleading. This is a Level 4 item in the reflecting/evaluating area. To be scored as correct, a response had to evaluate the text in relation to the word 'misleading' and point out that there is a potential contradiction, though it was not necessary to explain what the contradiction is. Two sample responses are shown. Both were marked as correct, though argued from different perspectives. Had the question been worth two marks, the first response would have been scored higher than the second, which relies mostly on another part of the information sheet.

Flu Question 4

Part of the information sheet says:

WHO SHOULD BE IMMUNISED?

Anyone interested in being protected against the virus.

After Fiona had circulated the information sheet, a colleague told her that she should have left out the words "Anyone interested in being protected against the virus" because they were misleading.

Do you agree that these words are misleading and should have been left out?

Explain your answer.

Yes. The sentence, to me, sounds as if it is saying if you get an injection you will be completely immune to the virus; which is not the case.

No I don't think that sentence is misleading. It gives a clear indication that it doesn't completely make you immune to the virus, just that it assists with the fighting of the virus.

A further multiple choice question, shown below, requires careful reading and interpretation of material in the text on who should and should not be immunised. This item, the last in the Flu unit, is at Level 3.

Flu Question 5

According to the information sheet which one of these staff members should contact Fiona?

A Steve from the store, who does not want to be immunised because he would rather rely on his natural immunity

B Julie from sales, who wants to know if the immunisation program is compulsory

C Alice from the mailroom who would like to be immunised this winter but is having a baby in two months

D Michael from accounts who would like to be immunised but will be on leave in the week of May 15

GRAFFITI

The 'Graffiti' unit features two letters obtained from the Internet containing arguments about the merits or otherwise of graffiti. The letters are shown below.

GRAFFITI

I'm simmering with anger as the school wall is cleaned and repainted for the fourth time to get rid of graffiti. Creativity is admirable but people should find ways to express themselves that do not inflict extra costs upon society.

Why do you spoil the reputation of young people by painting graffiti where it's forbidden? Professional artists do not hang their paintings in the streets, do they? Instead they seek funding and gain fame through legal exhibitions.

In my opinion buildings, fences and park benches are works of art in themselves. It's really pathetic to spoil this architecture with graffiti and what's more, the method destroys the ozone layer. Really, I can't understand why these criminal artists bother as their "artistic works" are just removed from sight over and over again.

Helga

There is no accounting for taste. Society is full of communication and advertising. Company logos, shop names. Large intrusive posters on the streets. Are they acceptable? Yes, mostly. Is graffiti acceptable? Some people say yes, some no.

Who pays the price for graffiti? Who is ultimately paying the price for advertisements? Correct. The consumer.

Have the people who put up billboards asked your permission? No. Should graffiti painters do so then? Isn't it all just a question of communication – your own name, the names of gangs and large works of art in the street?

Think about the striped and chequered clothes that appeared in the stores a few years ago. And ski wear. The patterns and colours were stolen directly from the flowery concrete walls. It's quite amusing that these patterns and colours are accepted and admired but that graffiti in the same style is considered dreadful.
Times are hard for art.

Sophia

The opening item is multiple choice, requiring an understanding of the purpose of the two letters. This is an item at Level 2.

Graffiti Question 1

The purpose of each of these letters is to

A explain what graffiti is.
B present an opinion about graffiti.
C demonstrate the popularity of graffiti.
D tell people how much is spent removing graffiti.

The second item requires students to interpret the text to explain why Sophia refers to advertising in her argument. The item is at Level 3, and students produced many interesting answers. A common wrong answer, as in the first example shown, was based on the inaccurate interpretation that Sophia was saying that graffiti is a form of advertising. The other examples were marked correct.

Graffiti Question 2

because she reckons that graffiti is a type of
Advertising

Because she see's advertising and graffiti as two very
similar forms of expression Companies plaster their names on
billboards without society's permission, so why shouldn't
graffiti artists?

Because she relates it to graffiti. How neither
ask the consumer (or onlooker) for permission
but still do it.

The third and fourth questions require some reflecting on and evaluation of the content and style of the letters. The third question, which is close to the boundary between Levels 2 and 3, is easier than the fourth. Provided that students could give a justifiable reason for saying which letter they agreed with, they were marked correct on it. If all they provided to support their opinion was a direct quotation from a letter, or if their response was vague or a misinterpretation of the text, or merely a statement of which writer they agreed with, they were marked incorrect because of its vagueness. The first three of the four examples shown below were assessed as correct and the fourth as incorrect. (Spelling mistakes in the students' answers were very common, but incorrect spelling had no bearing on whether an answer was marked correct.)

Graffiti Question 3

Which of the two letter writers do you agree with? Explain your answer by using **your own words** to refer to what is said in one or both of the letters.

I agree with Helga. It is hard enough to have goverment funding for parks and benches that tax payers pay for without us having to spend more money on cleaning up someones idea of 'art.' Such money could be put to better use.

I agree with Helga that graphiti is visual polltion and can ruin our public places. I admite the people who can do these pieces of art but wish they would do it legaly, and some where it is appropriate.

Sophia because I believe some graffiti can be beautiful to.

I agree with both of the letters, because they both have good points, that people just dont take any notice of

---

To be correct on the fourth question, the students needed to evaluate the letters in terms of form or style. An aspect such as style of writing, structure of argument, tone or use of persuasive strategies needed to be mentioned. Responses simply referring to content, or answering in terms of agreement or disagreement with the opinions of the letter writers, were not marked as correct. The item is at Level 3. Some very good answers were given. Of the five examples that follow here, the last is the only one that was marked incorrect.

Graffiti Question 4

We can talk about **what** a letter says (its content).

We can talk about **the way** a letter is written (its style).

Regardless of which letter you agree with, in your opinion, which do you think is the better letter? Explain your answer by referring to **the way** one or both letters are written.

Helga's has good personal voice, utilises facts for her arguments and thus has good justification

---

Sophia uses more persuasive techniques which and with the use of strong examples and evidence & alot of passion about what she is talking about, the style she uses is more effectively written

---

The next two responses are interesting in that they focus on the same feature, but use it in contrasting ways.

The better letter is Helga's because she gets straight to the point and doesn't ask so many questions. She just gives her opinion and facts.

I like the style of Sophia's letter better. Even though I don't fully agree with her opinion, I like the way that she asks the readers questions and makes them think about her opinion, possibly agreeing with it.

The following response is the one that was assessed as incorrect.

I think that Sophia's letter is the best one because it's content is alot better than Helga's letter

LABOUR

Only a handful of items in the test were at Level 5, and most of these have not been released. A sample Level 5 item is included here. It comes from a unit about the structure of a country's labour market, in which the information is presented as a complex tree diagram with divisions such as 'in the labour force' and 'not in the labour force', with many divisions below these. For each branch of the tree, numbers in thousands, such as 318.1, and the percentages of the branch represented by the numbers, are given. Definitions of the 'working-age population' and 'not in the labour force' are provided.

Labour Question 3

In which part of the tree diagram, if any, would each of the people listed in the table below be included?

Show your answer by placing a cross in the correct box in the table.

The first one has been done for you.

	"In labour force: employed"	"In labour force: unemployed"	"Not in labour force"	Not included in any category
A part-time waiter, aged 35	X			
A business woman, aged 43, who works a sixty-hour week	X			
A full-time student, aged 21			X	
A man, aged 28, who recently sold his shop and is looking for work		X		
A woman, aged 55, who has never worked or wanted to work outside the home			X	
A grandmother, aged 80, who still works a few hours a day at the family's market stall				X

The item, which belongs to the 'interpreting texts' sub-scale, is an example of what is referred to as a 'complex multiple choice' item. All five of the people described had to be correctly categorised for the student to be given a score of 2. If three or four were correct the answer was scored 1. This item is difficult because multiple pieces of information have to be dealt with, the tree diagram interpreted and the definitions taken into account in order to give the correct answers.

Performance on sample items

The Australian students' results on the items illustrated in this chapter are shown in Table 3.2, together with the results of the highest achieving country and the lowest achieving OECD country on each item. The highest achieving country was always an OECD country. Data from The Netherlands, which did not satisfy the sampling criteria, were not considered for this table. There is further discussion of item-level results near the end of the chapter.

Table 3.2 Selected Results (Percentages Correct) on Illustrated PISA Reading Items

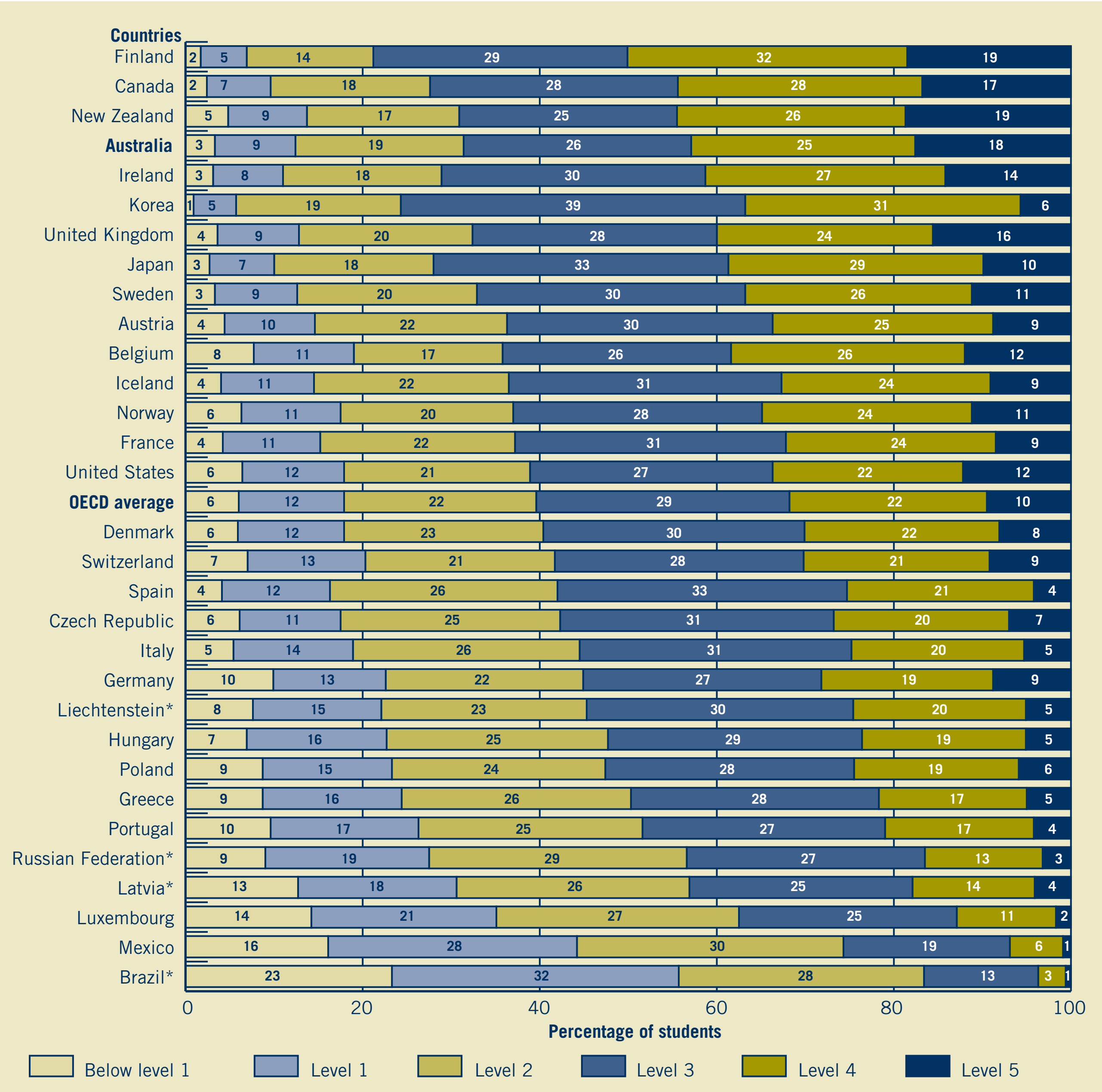
	Averages for OECD and individual countries			Averages for Australia		
	All*	Highest country	Lowest country	All	Females	Males
Running Shoes						
Question 1	85	91 (Sweden)	71 (Mexico)	88	91	86
Question 2	79	89 (Finland)	60 (Mexico)	81	87	77
Question 3	76	89 (Korea)	45 (Luxembourg)	83	86	80
Question 4	78	85 (Spain)	69 (Luxembourg)	81	85	77
Lake Chad						
Question 2	51	71 (Finland)	31 (Mexico)	58	55	60
Question 3	37	49 (Finland)	18 (Mexico)	35	37	33
Question 5	57	71 (Finland)	34 (Mexico)	62	61	63
Flu						
Question 1	71	79 (Austria)	47 (Mexico)	78	83	74
Question 2#	45	69 (UK)	24 (Mexico)	59	68	52
Question 4	31	48 (Finland)	13 (Mexico)	32	39	27
Question 5	45	58 (Korea)	33 (Luxembourg)	56	62	51
Graffiti						
Question 1	77	91 (Korea)	51 (Mexico)	84	87	81
Question 2	53	69 (Sweden)	38 (Mexico)	45	48	43
Question 3	68	79 (Ireland)	54 (Mexico)	66	69	63
Question 4	45	58 (Canada)	29 (Sweden)	49	57	42
Labour						
Question 3#	39	50 (France)	22 (Mexico)	42	46	39

* Countries were weighted equally in computing these statistics.
\# These items were each worth two score points. The results shown are percentages weighted for the numbers of fully and partially correct answers.

>> *Distributions according to reading proficiency level*

The percentages of students at each reading proficiency level are shown by country in Figures 3.2 to 3.5. The figures are made up of a series of stacked bars, each of which shows the percentage of students whose performance placed them at each of the five levels – in other words, those whose scores fell between the various pairs of cut-off scores that defined the boundaries of the levels. There is also a bar for the students who did not reach Level 1. The percentages in the stacked bars add to 100 per cent for each country. An example of the tables on which Figures 3.2 to 3.5 are based is included in Appendix 3 (Table A3.18). In the figures, countries are ordered according to their mean score on the combined reading scale.

Another way to look at the results in relation to proficiency levels is to consider cumulative percentages of students, according to the highest proficiency level reached. It is assumed that students at a level are also able to deal with tasks at lower levels of proficiency. The stacked bars in the figures presented here can be used in this way, as the different intensities of the colours used for the bars can be followed down by eye to gain an impression of countries' relative success in getting their students, for example, at least to Level 4.

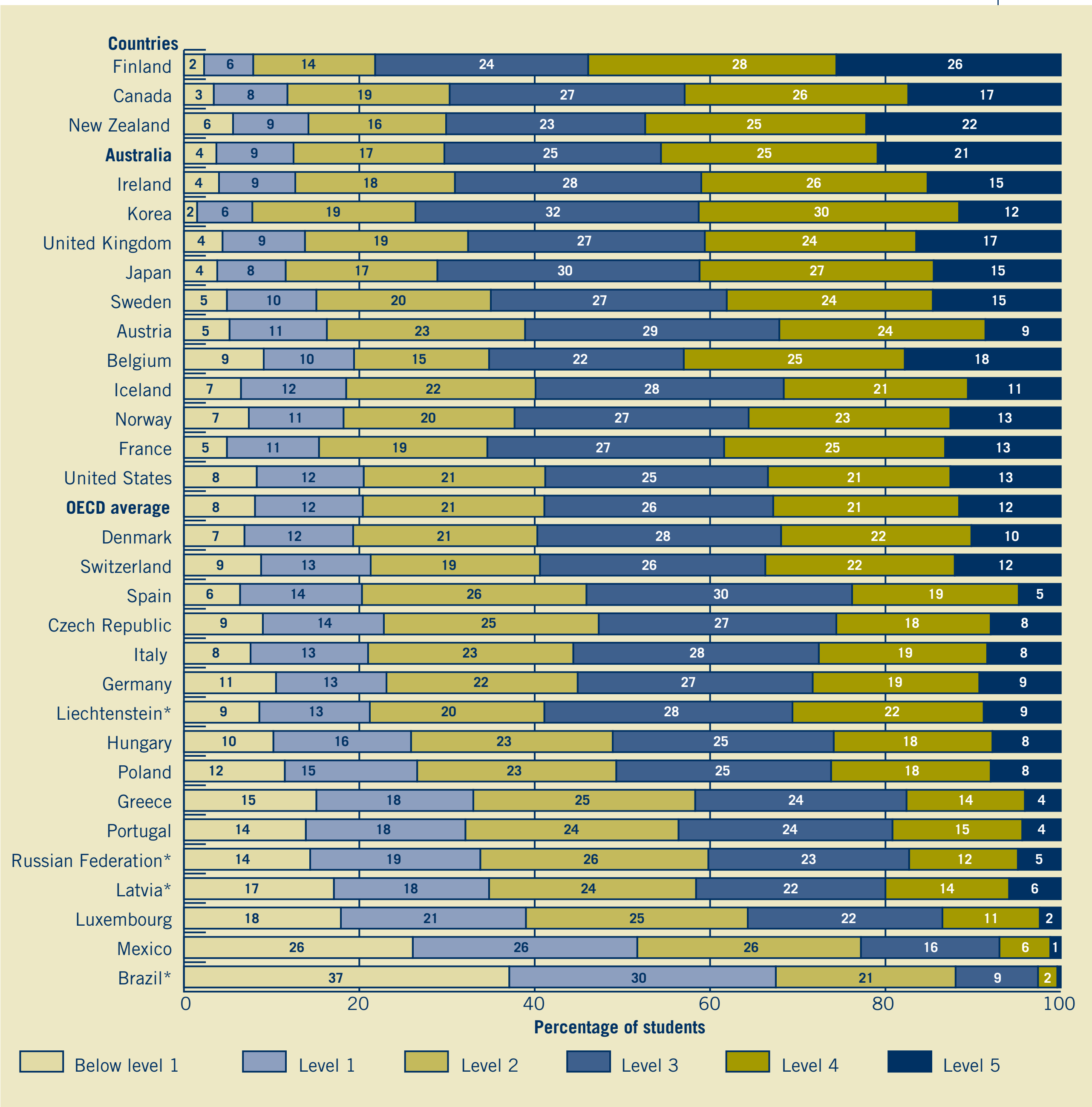


* Non-OECD country
Note: Totals may not add to 100 because of rounding.

Figure 3.2 Proficiency Levels for Students on the Combined Reading Literacy Scale

The distributions by proficiency level are, of course, influenced by the countries' mean performance in each reading process and also by how much variation there is within countries between the lowest and highest performers. Usually, if a country had a relatively high percentage of students at Level 5, it tended to have a relatively low percentage at or below Level 1, though there are exceptions to this. Finland had 19 per cent of students who were at Level 5 in reading literacy overall and under 2 per cent who could not demonstrate skills at least at Level 1. By contrast, the United States and Belgium each had an above average percentage of students at Level 5 but also an average or above average percentage who did not reach Level 1.

Differences in distributions by country of students' reading literacy proficiency levels are wide-ranging.

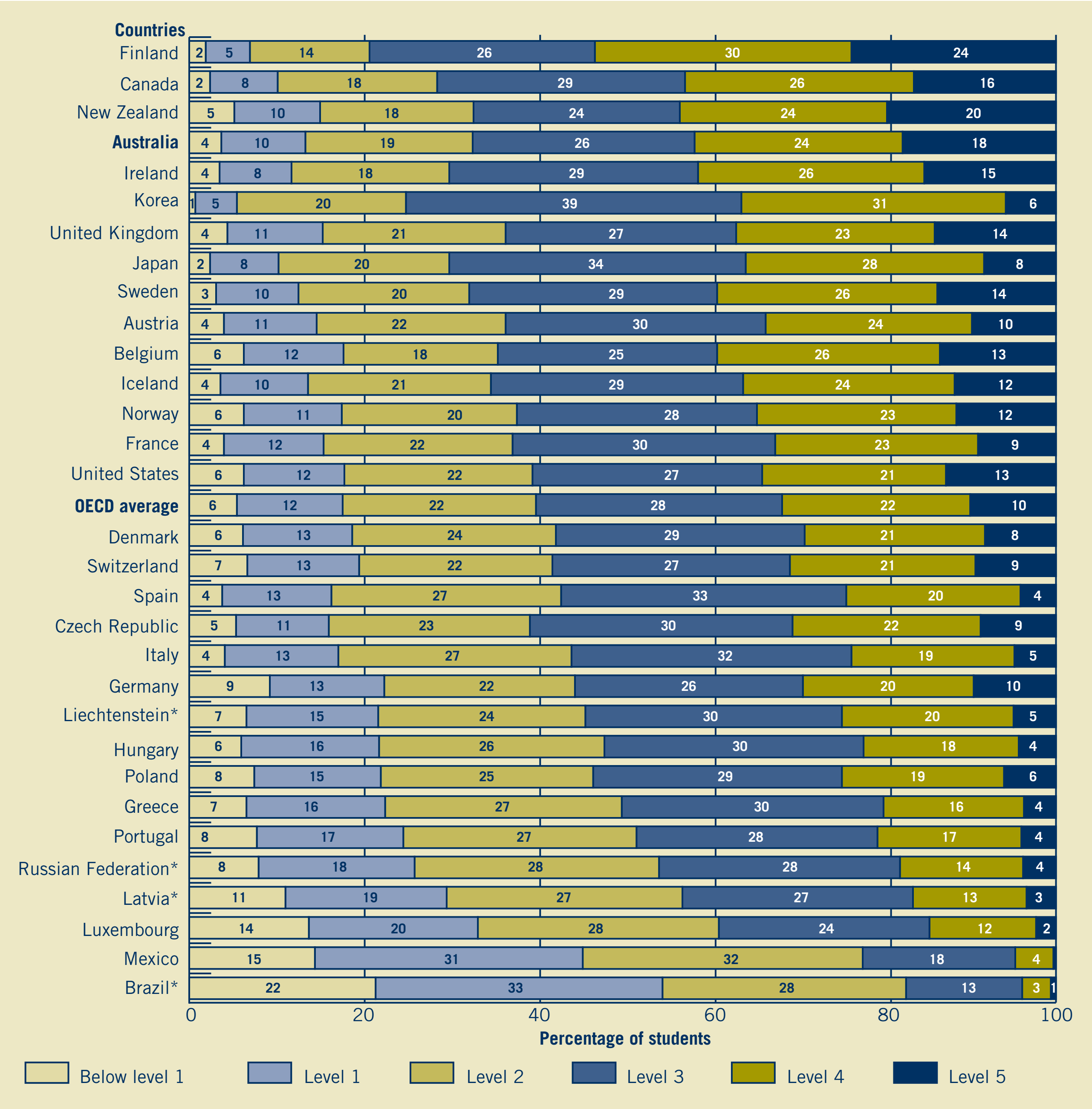


* Non-OECD country
Note: Totals may not add to 100 because of rounding.

Figure 3.3 Proficiency Levels for Students on the Reading: Retrieving Information Sub-scale

Level 5 proficiency

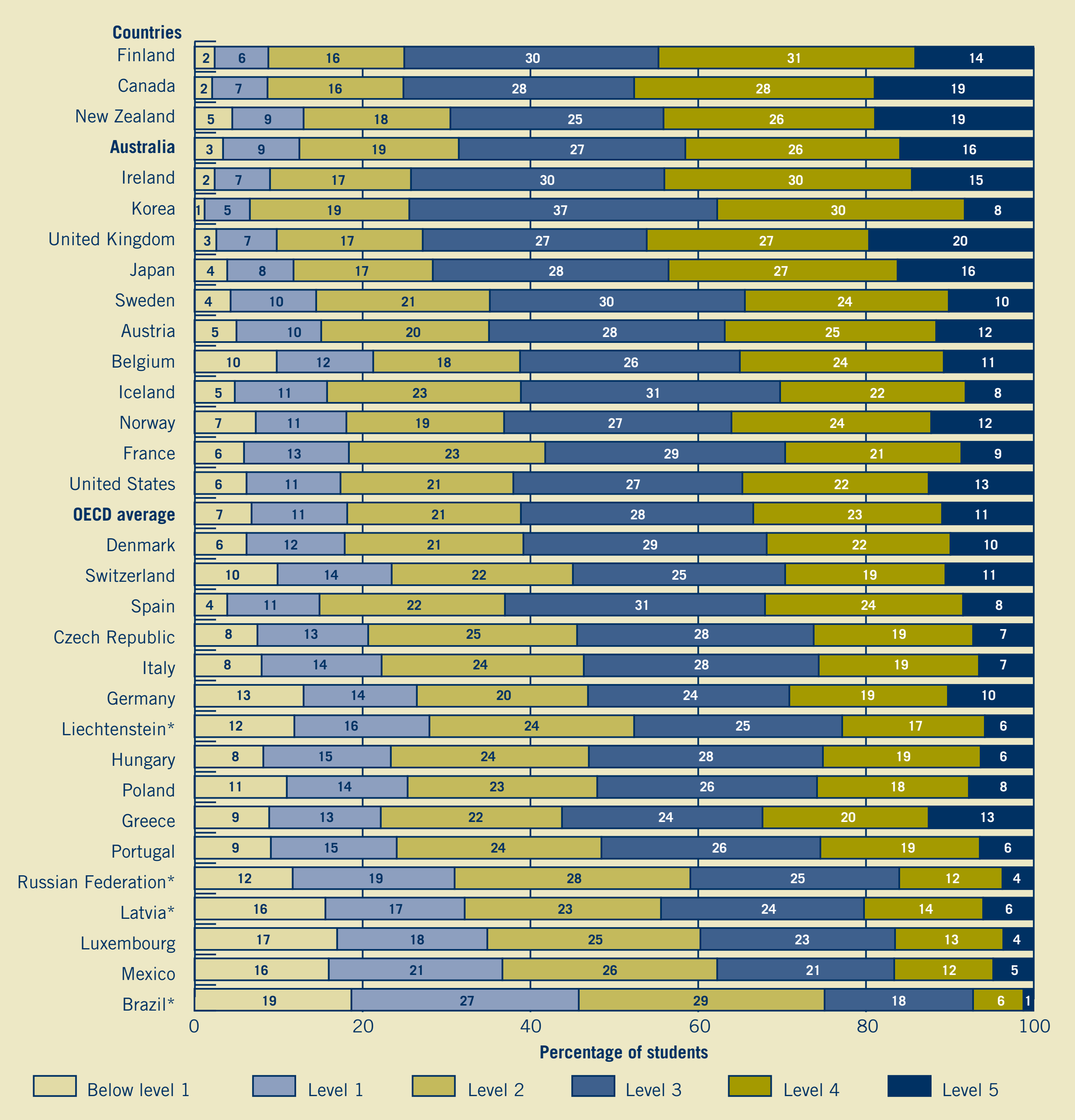
In summary, students classified as at Level 5 in reading proficiency are able to deal with difficult texts and to complete sophisticated reading tasks. They can deal with information that is difficult to find in unfamiliar texts, especially in the presence of closely competing information, show detailed understanding of these texts and sort out which information is relevant to the task. They are able to evaluate texts critically, draw on specialised knowledge to build hypotheses, and cope with concepts that may be contrary to expectations.



* Non-OECD country
Note: Totals may not add to 100 because of rounding.

Figure 3.4 Proficiency Levels for Students on the Reading: Interpreting Texts Sub-scale

On average across the OECD countries, about 10 per cent of the students assessed in PISA were at Level 5 on the combined reading literacy scale. With respect to the reading processes, the average for retrieving information was about 12 per cent, for interpreting texts, about 10 per cent, and for reflecting and evaluating, about 11 per cent. There was wide variation between countries. Finland and New Zealand both had 19 per cent and Australia had 18 per cent of students at Level 5 for reading literacy overall, whereas Luxembourg and Mexico, of OECD countries, had fewer than 2 per cent at this level. In addition to Finland,



* Non-OECD country
Note: Totals may not add to 100 because of rounding.

Figure 3.5 Proficiency Levels for Students on the Reading: Reflecting on and Evaluating Texts Sub-scale

New Zealand and Australia, which had the highest percentages of students at Level 5, Canada, the United Kingdom, Ireland, the United States and Belgium each had 12 per cent or more of their students at this level. Five per cent or fewer were at Level 5 in Greece, Portugal, Spain, Latvia, the Russian Federation and Brazil, as well as in Luxembourg and Mexico as already mentioned.

For the OECD countries combined, from 10 to 12 per cent of students reached the highest proficiency level assessed in PISA. In Australia, 18 per cent were placed at this level on the total reading literacy scale.

Profiles of proficiency across the three reading processes reinforce the discussion on means and distributions of achievement scores in Chapter 2. In Finland, for example, 26 and 24 per cent of students were at Level 5 on the retrieving information and interpreting texts sub-scales, respectively, but only 14 per cent were at this level on the reflecting/evaluating sub-scale. The opposite pattern occurred in Canada and the United Kingdom, with 14 to 17 per cent of students at Level 5 on the retrieving and interpreting sub-scales but over 19 per cent on the reflecting/evaluating sub-scale. Australia had a different pattern again, with 21 per cent at Level 5 in retrieving information, 18 per cent at this level on the interpreting sub-scale and 16 per cent at this level on the reflecting/evaluating sub-scale. Among lower achieving countries, Greece had only 4 per cent of students at Level 5 on retrieving but 13 per cent on reflecting/evaluating. These profiles, particularly those in Canada, the United Kingdom and Greece that go against the more general pattern, suggest that there may be different emphases in the kinds of tasks students are expected to do with texts in their schoolwork.

There were small differences in the percentages of Australian students at Level 5 on the reading sub-scales – 21 per cent for retrieving information; 18 per cent for interpreting texts; and 16 per cent for reflecting on and evaluating texts.

Level 4 proficiency

In summary, students classified as at Level 4 in reading proficiency are able to cope with difficult tasks, such as locating embedded information, construing meaning of part of a text through considering the text as a whole, and dealing with ambiguities and negatively worded ideas. They show accurate understanding of complex texts and are able to evaluate texts critically.

On average, 22 per cent of students in OECD countries were at Level 4, and 32 per cent were proficient at Level 4 or higher on the combined reading literacy scale. More than half of the students in Finland and 40 per cent or more in Canada, New Zealand, Australia, Ireland and the United Kingdom were at Level 4 or 5. The lowest-performing OECD countries in this respect were Luxembourg, with 13 per cent, and Mexico, with only 7 per cent, of students at these levels. In Brazil, a non-OECD country, only 4 per cent were proficient at Level 4 or higher.

More than 40 per cent of the Australian students reached at least Level 4 in reading literacy overall ….

Level 3 proficiency

In summary, students classified as at Level 3 in reading proficiency can deal with moderately complex reading tasks, such as finding several pieces of relevant information and sorting out detailed competing information requiring consideration of many criteria to compare, contrast or categorise. They are able to make links between different parts of a text and to understand text in a detailed way in relation to everyday knowledge.

On average, 29 per cent of students in OECD countries were at Level 3, with just over 60 per cent proficient at this level or higher on the combined reading literacy scale. In nine countries two-thirds or more reached at least Level 3. Australia was placed in this group, with 69 per cent of its students at Levels 3, 4 or 5. Highest in this respect were Finland (79 per cent) and Korea (76 per cent). Only about a quarter of Mexican students and a sixth of Brazilian students reached at least Level 3.

…. and two-thirds reached at least Level 3.

Level 2 proficiency

In summary, students classified as at Level 2 in reading proficiency can cope with basic reading tasks, such as locating straightforward information, making low-level inferences, using some outside knowledge to help understand a well-defined part of a text, and applying their own experience and attitudes to help explain a feature of a text.

On average, 22 per cent of students in OECD countries were at Level 2 and over 80 per cent were at Level 2 or higher. In all but one OECD country, Mexico, 65 per cent or more of the students reached at least Level 2; in Mexico the percentage was 56. In Australia, 88 per cent of the students reached at least this level. The Czech Republic, Italy and Spain are interesting cases because they had more than the OECD average percentage of students achieving at Level 2 or higher, but this was because they each had a high concentration of students achieving at Level 2.

Over 80 per cent of students in the OECD as a whole reached at least Level 2. The corresponding percentage in Australia was 88.

Level 1 proficiency

Students classified as at Level 1 in reading proficiency are able to deal with only the least complex reading tasks developed for PISA, such as finding explicitly stated pieces of information and recognising the main theme or author's purpose in a text on a familiar topic when the required information is readily accessible in the text. They are also able to make a connection between common, everyday knowledge and information in the text.

Across the OECD, countries varied between 28 per cent of their students at Level 1 in Mexico and 21 per cent in Luxembourg to only 5 per cent in each of Finland and Korea. The OECD average was 12 per cent at this level. Japan and Canada had only 7 per cent of their students at this level, Ireland had only 8 per cent and Australia, New Zealand, Sweden and the United Kingdom each had only 9 per cent.

Nine per cent of Australian students performed at only the first proficiency level. The OECD average was 12 per cent.

Proficiency not yet at Level 1

Reading tasks any easier than the Level 1 tasks in PISA no longer fit PISA's concept of reading literacy as skills that will enable young adults to participate fully in society beyond school. Students performing below the lower boundary of Level 1 have not demonstrated even the most basic type of information retrieval and understanding of text that PISA measures. These students are likely to be seriously disadvantaged in their lives beyond school, and even students who have not progressed beyond Level 1 are likely to experience problems in some spheres of adult life.

On average, 6 per cent of students in OECD countries were unable to demonstrate Level 1 reading skills in PISA. Thirteen OECD countries and all of the non-OECD countries in PISA had more than 5 per cent of their 15-year-olds in this category. The most disadvantaged countries in this respect were Brazil

Across the OECD as a whole, six per cent of students did not demonstrate even the lowest skill level assessed in PISA. In Australia, three per cent of students were in this category.

(23 per cent below Level 1), Mexico (16 per cent), Luxembourg (14 per cent), Latvia (13 per cent) and Portugal (10 per cent). In Australia, 3 per cent of the students could not do even the simplest of PISA's reading tasks. Only Finland and Canada (both with 2 per cent) had lower percentages of students in this category.

The percentage of students excluded from the assessment for reasons of intellectual disability could be expected to have an effect on the proportion of students not reaching Level 1. Students could be excluded for several other reasons, including extreme remoteness, severe physical disability or unfamiliarity with the language of the test because they were recent arrivals in the country, up to a maximum exclusion rate of 5 per cent of the cohort (see Appendix 2). Exclusion of schools catering solely for students in these categories was also permitted, within the overall exclusion limit. In Australia, about 1.2 per cent of students were excluded at school level – students undertaking distance education and those in schools for students with severe disabilities – and a further 1.2 per cent were excluded from the assessment by their schools.

Finland also had about 2 per cent of exclusions. In Canada, however, the exclusion rate was 5 per cent, most of these being students within schools and who thus would be expected to be among the lowest achievers had they attempted the test. The United States also had over 4 per cent of students excluded within schools, followed by Sweden (3.4 per cent), New Zealand (3.3 per cent) and Ireland (3 per cent). Apart from Luxembourg and Poland, which excluded some schools on language criteria, countries with a combined exclusion rate of over 4 per cent were New Zealand (5.1 per cent), Canada and the United Kingdom (each 4.9 per cent), Sweden (4.7 per cent), Ireland (4.6 per cent), The Netherlands (4.4 per cent) and the United States (4.1 per cent). The lowest percentage of excluded students occurred in Korea (0.4 per cent) and Austria, Greece, Hungary and Mexico each excluded fewer than 1 per cent of their student cohorts from the assessment.

>> *Further consideration of results on reading literacy items*

The discussion of means and distributions of reading literacy results in Chapter 2 and the information on proficiency levels in the current chapter have shown a generally favourable picture of Australian students' reading literacy skills in comparison with the skill levels demonstrated by their counterparts in other countries. Nevertheless, within Australia there remain areas of concern. We would like *all* of our 15-year-old students, not just 88 per cent of them, to be able to do at least the most basic of PISA's reading tasks and we would prefer, for the sake of their future lives, that all our students could achieve at least proficiency level 3.

We would also prefer to raise the level of reading skills of our lowest quarter of students so that the gap in reading performance between our lowest and highest quarters, which is greater than the OECD average gap (see Chapter 2), could be narrowed. Thus, it is useful to understand the composition of the lowest performing group of students, and to identify areas of particular weakness in our students' reading skills. Our best students are currently achieving on a par with the world's best in PISA, but, to help them maintain that position, it is useful to know the characteristics of this group, which tasks they are particularly successful in tackling and which tasks they could do better. Additional analyses of the PISA data were undertaken to investigate these issues. The analyses in terms of strengths and weaknesses are summarised here, while the analyses of the high and low performing groups of students are reported in Chapter 9.

Additional analyses of the Australian data were done to see if strengths and weaknesses in particular areas of the reading framework could be identified.

Table 3.1 indicates that there were altogether 141 reading items in PISA 2000. Results are available at item level for only 128 of these, however, as a few were deleted following analyses of item–country interaction effects and only one result each was reported on a few compound items. The additional analyses at item level to identify areas of strength and weakness in Australia included comparisons of:

a) the per cent correct in Australia and the OECD average per cent correct;
b) the per cent correct in Australia and the highest country per cent correct;
c) the distributions of item and text characteristics in the highest and lowest thirds of items based on the Australian per cents correct;
d) gender differences in relation to the highest and lowest thirds of items as in c)
e) average per cents correct and gender differences in Australia for items classified by text structure, text type and OECD item difficulty.

The analyses were undertaken to identify patterns, not to test hypotheses about significant differences. The discussions below are descriptive only.

Australia compared with the OECD as a whole

On about half the reading literacy items the percentage of Australian students giving a correct response was within 5 per cent of the average per cent correct across all OECD countries. The Australian students' performance per item was more than 5 percentage points higher than the OECD average on 52 items, including 16 on which the Australian result was more than 10 percentage points higher. By contrast, Australia's performance per item was more than 5 per cent below the OECD average on only 10 items, including only six with a difference of more than 10 percentage points. It is informative in some respects to look at the items with the greatest differences, positive and negative, between the Australian and the OECD average results.

The set of 16 items on which Australia performed particularly well relative to the OECD average includes all of the items from the Flu unit shown earlier in the chapter, except the one shown as Question 4. Seven of the 16 items are from the interpreting sub-scale, six are from the reflecting/evaluating sub-scale and three are from the retrieving sub-scale. Seven require extended responses to be provided, six are multiple choice and the remainder are short or closed response items. The items are spread in difficulty, with 10 at or below proficiency Level 3, four at Level 4 and two at Level 5, and are equally divided between continuous and non-continuous texts. In terms of the distributions for the whole test, the reflecting/evaluating sub-scale is over-represented, as is the 'open constructed' item type. The most striking feature of this set of items is that it contains no narrative texts and there is an over-representation of schematics/maps/forms/tables.

With respect to strengths, the Australian students (on average) performed outstandingly well relative to the OECD average on 16 items. More of these items than expected were associated with schematics, maps, forms and tables; none pertained to a narrative text.

The set of six items on which Australia achieved a result of more than 10 percentage points below the OECD average per cent correct per item includes

There were only six items where the Australian students' performance was very low compared with the OECD average. All were associated with continuous texts.

three pertaining to narrative texts, two to expository texts and one to an argumentative text (the Graffiti item shown as Question 2 earlier in this chapter). Four are 'open constructed' items and two are multiple choice, mostly at a medium level of difficulty. All involve continuous text and come from either the interpreting or the reflecting/evaluating sub-scale.

Australia compared with the highest achieving country on each item

Australia achieved the highest result of any country on four of the reading items, none of which has been released. There is nothing systematic about the four items as a set – they are from four different units, four different contexts, are in four different formats and involve four different text types, two with continuous and two with non-continuous text structure.

Looking at a wider range, there were 43 items, or about a third of the total number, on which Australia's per cent correct was within 5 per cent of the highest per country result. An examination of the characteristics of these 43 items compared with the 43 items for which Australia's result was furthest below the highest result for that item yielded the information presented in Table 3.3. The table shows actual numbers of items in various categories. More importantly, it shows the percentages of items in each category for the total test and for the two contrasted subsets of items – that is, for the subset on which Australia achieved the highest or close to the highest country result and the subset where Australia's performance was furthest from that of the highest country. It is most relevant to compare these three columns of percentages.

Dividing the items into three sets in terms of how well the Australian students performed on them, there was still a relative lack of items on continuous texts in the top third. Items relating to continuous texts were over-represented in the lowest third.

The percentages of items are quite similar in many instances, but some differences stand out. Items associated with continuous texts are under-represented, compared with the test as a whole, in the 'closest to highest country' group and over-represented in the 'furthest from highest country' group. The same pattern is true for open constructed items, while the reverse is true for multiple choice items. In keeping with the preponderance of continuous items in the 'furthest from highest' group, descriptive and narrative items are over-represented in that group, while argumentative and narrative items are under-represented in the 'closest to highest' group. Items from the interpreting texts sub-scale are under-represented, and the other two sub-scales are slightly over-represented, in the 'closest to highest' group, while reflecting/evaluating items are over-represented and retrieving information items are under-represented in the 'furthest from highest' group.

Taken together, these two sets of analyses – of Australia compared with the OECD as a whole and compared with the highest achieving countries item by item – provide a picture of Australian students coping better with non-continuous texts than with continuous texts. For continuous texts, the students coped less well with narrative, descriptive and argumentative texts than they did with expository or injunctive (procedural) texts.

Table 3.3 Numbers and Percentages* of Items in Various Framework Categories

	Total test	Final test		Closest to highest country#		Furthest from highest country#	
	N items	*N* items	%	*N* items	%	*N* items	%
Distributions of reading items by text structure							
Continuous	89	87	68	24	56	35	81
Non-continuous	52	41	32	19	44	8	19
Total	**141**	**128**	**100**	**43**	**100**	**43**	**100**
Distributions of reading items by reading process							
Interpreting	70	64	50	19	44	21	49
Reflecting	29	29	23	11	26	12	28
Retrieving Information	42	35	27	13	30	10	23
Total	**141**	**128**	**100**	**43**	**100**	**43**	**100**
Distributions of reading items by text type							
Argumentative/Persuas.	18	17	13	3	7	6	14
Descriptive	13	12	9	3	7	7	16
Expository	31	31	24	11	26	10	23
Injunctive	9	9	7	3	7	4	9
Narrative	18	18	14	4	9	8	19
Advertisements	4	2	2	1	2	0	0
Charts/Graphs	16	14	11	6	14	3	7
Forms	8	4	3	3	7	0	0
Maps	4	4	3	3	7	1	2
Schematics	5	5	4	2	5	1	2
Tables	15	12	9	4	9	3	7
Total	**141**	**128**	**99**	**43**	**100**	**43**	**99**
Distributions of reading items by item type							
Multiple choice	56	54	42	22	51	13	30
Complex MC/Closed	22	18	14	6	14	3	7
Open constructed	43	39	30	10	23	20	47
Short response	20	17	13	5	12	7	16
Total	**141**	**128**	**99**	**43**	**100**	**43**	**100**

* Percentages may not add to 100 because of rounding.
\# From Australia's perspective

Other analyses at item level

Given the Australian students' difficulties with continuous texts and the gender differences on the reading literacy scales discussed in Chapter 2, some further analyses were undertaken on the Australian data to see if the relatively low performance on continuous texts might be associated with gender. The evidence suggests that this was indeed the case. In terms of average percentages correct by text type, the gender difference was greatest for narrative items, followed by injunctive and argumentative items, then expository items and descriptive items. It was much lower, and probably not significant, on items associated with the various kinds of non-continuous text. This result agrees with findings from the IEA Reading Literacy survey carried out in 32 countries (but not including Australia) from 1989 to 1991. Wagemaker (1996) reports that, for all countries combined, there was no difference between 14-year-old boys' and girls' performance in the 'document' domain but that the girls were clearly ahead in the 'narrative' and 'expository' domains.

Looking at average percentages correct by text type, there were significant gender differences in results for each type of continuous text but not for types of non-continuous text. Significant differences were always in favour of females.

The findings in Australia for PISA 2000 show up quite dramatically in Table 3.4, which displays numbers of items within four ranges of difference in item facility (per cent correct) from the per cent correct in the highest performing country on each item. The numbers of items in each range are shown separately for the Australian females and males as an indication of the relative performance of the gender groups on items associated with the various text types.

Table 3.4 Numbers of Items in Given Ranges from the Highest Per Country Result, by Gender

		Number of items in given range from highest country result							
		Within 5%		Between 5 & 10%		Between 10 & 20%		More than 20%	
	Total	Female	Male	Female	Male	Female	Male	Female	Male
Distributions of items associated with continuous texts									
Argumentative	17	11	1	3	5	1	7	2	4
Descriptive	12	4	1	1	2	4	3	3	6
Expository	31	18	4	5	11	5	9	3	7
Injunctive	9	3	0	2	2	4	3	0	4
Narrative	18	8	1	4	5	3	5	3	7
Distributions of items associated with non-continuous texts									
Charts/graphs	14	6	5	5	5	3	4	0	0
Maps/schematics	9	6	3	1	2	2	4	0	0
Tables	11	4	3	5	4	2	3	0	1

For males, the lack of items associated with continuous texts in the column for results within 5 per cent of the highest result can clearly be seen, with correspondingly larger numbers in the other ranges. The table also shows that the females did not acquit themselves particularly well either, relative to the highest achieving OECD country in each case. Only in the argumentative, expository and maps/schematics areas was the females' performance close to the highest result on more than half of the items.

Based on this analysis, the males had problems with all kinds of continuous texts, but particularly with narrative, argumentative and descriptive texts.

>>

Summary

Several kinds of analyses which add meaning to PISA reading literacy results are reported in this chapter. The main feature is the 'described proficiency scales' for each of the three reading processes on which the PISA assessment of reading focuses, that is, retrieving information, interpreting texts, and reflecting on and evaluating texts. Item Response Theory techniques were used to place all the reading items onto the same scale, a scale which at the same time could be used to measure the students' performance. Scales were also developed for the three reading processes. Using expert judgement together with the response data for the OECD as a whole, cut-off scores were set to define five levels of proficiency on the combined reading scale and for each of the three reading processes. Descriptions of the tasks at each level together with the skills typically needed to respond to the tasks successfully were then prepared, and were endorsed by the Board of Participating Countries for use in reporting results. The full set of descriptions is presented in the chapter, followed by some sample items chosen to illustrate the various proficiency levels, reading processes, item types and item difficulties. An example of the instructions for marking open-ended items is also included.

Following the sample items, the percentages of students at each proficiency level are presented graphically for each country. For the OECD as a whole, about 10 per cent of students were at Level 5 on the combined reading literacy scale, 22 per cent were at Level 4, 29 per cent at Level 3, 22 per cent at Level 2 and 12 per cent at Level 1. While the great majority of students in almost all countries were placed in one of the five defined proficiency levels, there was an average over all OECD countries of 6 per cent of students who were unable to do the simplest reading tasks measured by PISA. The reading literacy skills of these students are not known, and hence the students are described as 'below Level 1'. Thirteen OECD countries and all of the non-OECD countries in PISA had more than 5 per cent of their 15-year-olds in this category.

The Australian students demonstrated relatively high levels of proficiency in reading literacy. Eighteen per cent achieved Level 5 (highest were Finland and New Zealand, with 19 per cent at this level); 25 per cent were at Level 4; 26 per cent at Level 3; 19 per cent at Level 2; 9 per cent at Level 1; and 3 per cent did not reach Level 1. Only Canada and Finland (2 per cent) had a lower percentage of their cohort who could not be placed in one of the defined proficiency levels. Discussion of countries' rates of exclusion from PISA of students with severe disabilities, and the likely impact of this on the cohort proportion recorded as not reaching Level 1, is included in the chapter.

Considering cumulative proportions, almost a third of students in the OECD as a whole were at Level 4 or higher on the combined reading literacy scale, about 60 per cent were at Level 3 or higher and over 80 per cent were at Level 2 or higher. More than half of the students in Finland reached at least Level 4 and more than 40 per cent in Australia, Canada, Ireland, New Zealand and the United Kingdom did likewise. Altogether nine countries, including Australia, had two-thirds or more of their students reaching Level 3. In Australia, only 12 per cent of students did not reach at least Level 2. Without the opportunity as yet to follow students into the labour market or further study, PISA has not attempted to say what constitutes a

minimum level of reading literacy for full participation in adult society. However there is strong evidence from other studies that, other things being equal, students with higher levels of reading literacy achieve more satisfactory outcomes in the labour market. The group not achieving at least Level 2 by age 15 would seem to be at risk of disadvantage in their later lives.

In keeping with the variation between means within some countries on the three reading processes, variations were also found in the distributions of students by proficiency level. In Finland, for example, 26 and 24 per cent of students were at Level 5 on the retrieving and interpreting sub-scales but only 14 per cent were at this level on reflecting/evaluating. Countries with varying profiles across the three processes tended to follow the pattern of Finland, being higher in the first two processes and lower in the third. The Australian pattern was a little different, in that 21 per cent were at Level 5 on retrieving, 18 per cent were at this level on interpreting and 16 per cent were at this level on reflecting/evaluating. The results in Canada, Greece and the United Kingdom, where greater percentages were at Level 5 on reflecting/evaluating than on the other two sub-scales, suggest that there may be different emphases in the kinds of tasks students are expected to do with texts in their schoolwork.

Finally, the chapter contains some analyses of results at item level in an attempt to identify reading literacy strengths and weaknesses in Australia. These analyses revealed that our students coped relatively much better with tasks associated with non-continuous texts (such as filling in forms, or reading timetables, diagrams and maps) than they did with tasks associated with continuous texts such as narrative, argumentative and descriptive texts. It may be that, with the current emphasis on covering a wide range of genres in Australian school curricula, narrative and other continuous text types receive less emphasis than in other countries. The analyses undertaken at item level suggest that the gender difference in reading literacy in Australia relates to continuous texts, not to non-continuous texts, echoing the overall results for the 14-year-old population in the IEA Reading Literacy survey carried out in 1989-91 (Australia did not participate in that study).

Chapter **FOUR**

ADDING MEANING TO PISA RESULTS: STUDENTS' SKILLS IN MATHEMATICS AND SCIENCE

>> *PISA's coverage of mathematical literacy*

Results in mathematical literacy are reported for PISA 2000 on a single scale, based on all the items in the domain. Just as in reading, the domain is described in an assessment framework that has several aspects. Sub-scales for reporting of results will be developed in PISA 2003 when mathematics is the major domain. The distribution of the 32 mathematical literacy items is shown by framework aspect and item type in Table 4.1. The items were worth a total of 40 score points. The aspects and item types are explained on the following pages.

As we saw in Chapter 1, the assessment framework for mathematical literacy in PISA 2000 features three broad dimensions: mathematical content; mathematical processes; and the situations in which mathematics is used. Given that PISA 2000 results in mathematical literacy are reported on a single scale, without detailed descriptions of what is involved in demonstrating skills at various levels in relation to the different aspects, the aspects are described here in a little more detail than the reading aspects were in the previous chapter.

Content

The PISA mathematics framework is innovative in specifying content in terms of broad mathematical concepts and underlying mathematical thinking, rather than the more traditional strands associated with school curricula. These broad areas are referred to in the framework as *mathematical big ideas*, several of which are defined. The areas of *growth and change* and *space and shape* were selected for the limited mathematics assessment in PISA 2000. Other broad areas, for example, quantitative reasoning, will be added in PISA 2003 when mathematics, as the major assessment domain, will have more time allocated to it.

The major areas of 'growth and change' and 'space and shape' were assessed in mathematics in PISA 2000.

Table 4.1 Classification of Assessment Items for the Mathematical Literacy Scale

Framework aspect	Item type and number of items: Multiple choice	Closed constructed responses	Open constructed responses	Total
Distribution of items by mathematical big idea (content)				
Growth and change	6	9	3	18
Space and shape	5	9	-	14
Total	**11**	**18**	**3**	**32**
Distribution of items by curricular strand (content)				
Algebra	-	4	1	5
Functions	4	-	1	5
Geometry	3	5	-	8
Measurement	3	4	-	7
Number	-	1	-	1
Statistics	1	4	1	6
Total	**11**	**18**	**3**	**32**
Distribution of items by competency class (process)				
Class 1	4	6	-	10
Class 2	7	11	2	20
Class 3	-	1	1	2
Total	**11**	**18**	**3**	**32**
Distribution of items by situation (context)				
Community	-	2	2	4
Educational	2	3	1	6
Occupational	1	2	-	3
Personal	6	6	-	12
Scientific	2	5	-	7
Total	**11**	**18**	**3**	**32**

While mathematical big ideas are the first level of classification in the framework, each PISA 2000 mathematics assessment item has also been classified according to the main *curricular strand* of mathematics it involves. The strands are listed in the classification table. The particular big ideas featured in PISA 2000 were chosen because they can accommodate items from a range of strands without giving undue weight to number skills. It was prescribed in advance that equal assessment time should be given to the two big ideas, and that as many as possible of the curriculum strands should be represented.

Within growth and change, PISA assesses students' ability to understand different types of change, to recognise and interpret particular types of change when they occur, and to represent changes in comprehensible ways. Aspects assessed include rates of growth, growth curves and understanding the relations they represent, and growth patterns and how these can be expressed both graphically and in algebraic form. Growth can also be measured empirically, and decisions need to be made about the best way to represent the data and what can validly be inferred from them. Thus, this big idea also accommodates data representation, analysis and statistical inference.

Within space and shape, PISA assesses recognition of shapes in different representations, orientations and dimensions, understanding of relations between shapes and visual representations (for example, how three-dimensional objects can be represented in two dimensions), and understanding what happens to two- or three-dimensional forms when linear dimensions are changed. The students need to look for similarities and differences and use their observations to help them analyse components of shapes. Accommodated within this big idea are aspects of geometry such as properties of two- and three-dimensional figures, angles, perspective, parallelism and symmetry; aspects of trigonometry such as triangulation; and aspects of measurement such as area and volume.

Processes

A comprehensive set of mathematical processes is described in the framework, organised into three main groups referred to as *competency classes*. The processes include representation (choosing and moving between different forms of representation as appropriate for the situation); working with symbols (interpreting relationships expressed in symbols, handling formulae, using variables, solving equations); posing and solving problems (formulating and solving different kinds of mathematical problems, in a variety of ways); mathematical modelling (expressing a problem in mathematical terms, interpreting in everyday language a situation expressed mathematically, understanding the limitations of a model); thinking mathematically (knowing the kinds of questions that mathematics can answer, distinguishing between definitions, proofs, hypotheses, examples); and communicating to others about mathematical components of situations as well as understanding others' communications about these.[1]

In the competency classes, mathematical processes are organised according to the nature of the skills implied by the processes. PISA's emphasis is on students' abilities to analyse, reason and communicate ideas effectively, and to pose, formulate and solve mathematical problems. These processes can operate at several levels, depending on the type and extent of mathematical thinking required. During the PISA 2000 assessment, students were permitted to use whatever type of calculator they were familiar with from their classroom routines. The processes involved in some items may have been different to some extent for students who used a calculator than for students who did not.

Three 'competency classes' are defined, depending on the skills being assessed.

One competency class consists of routine computations, reproduction of definitions or facts, recognising equivalents and recall of mathematical relationships or properties, for example. This class is referred to in the framework as Class 1. Class 2 includes making connections and using reasoning to solve relatively straightforward non-routine problems, decoding and interpreting formal language, and distinguishing and relating different kinds of statements. The third class involves more complex mathematical thinking, analytical reasoning and generalisation, as well as having insight into the nature of mathematics as a science.

[1] The examples of processes given in this paragraph are illustrative, not exhaustive.

The framework considers that this class 'goes to the heart of mathematics and mathematical literacy' (OECD, 2000a), but in practice it was difficult to assess in PISA 2000 along with other items in the one hour of assessment time available to mathematics as a minor domain. There will be more scope for inclusion of Class 3 items in PISA 2003 when mathematics is the major domain.

Situations and contexts

The situations in which the PISA mathematics tasks are set are classified as community/society, educational, occupational, personal and scientific. The tasks attempt to represent the kinds of problem that people encounter in real life, though scientific situations would be less common than the others. Mathematics is relevant to many spheres of real life, and the situations aspect of the mathematics framework is used to ensure that the mathematics items pertain to a range of contexts. In recognition of the age of PISA respondents (15 years), less emphasis is given to community and occupational contexts, which are less relevant for them than the other classes of contexts.

Types of assessment items

As for reading literacy, the framework categories for mathematical literacy were assessed through a range of item types. The distribution of the item types is also shown in Table 4.1, together with the framework categories. Some items were multiple choice; some were 'complex multiple choice' (mostly requiring a series of True/False or Yes/No answers within the item, and grouped in the table with the next category described here); some, referred to as 'closed constructed response', required recall of knowledge or minimal working leading to a clear-cut short answer; and some, referred to as 'open constructed response', required extended working and explanation of the response given.

>> *Students' proficiency in mathematical literacy*

As already mentioned, the small number of mathematics items used in PISA 2000 meant that performance in mathematical literacy could only be reported against a single scale, not against a total scale and sub-scales as was done for reading. The scale was constructed to have a mean of 500 and a standard deviation of 100, meaning that almost two-thirds of students across OECD countries obtained scores between 400 and 600 scale score points. The scale measures students' ability to carry out the range of mathematical processes in relation to the content areas and representations of the various situations described in the assessment framework.

The small number of mathematics items also meant that insufficient information was produced on which to base descriptions of proficiency levels analogous to those derived for reading literacy. Nevertheless, it was possible to distinguish characteristics of tasks at low, medium and high levels of difficulty on the scale and to describe relatively low, average and relatively high degrees of proficiency in relation to the groups of tasks. Several features of tasks come into play in determining where the tasks are located along the scale of increasing difficulty. These include the number and complexity of processing steps required, how much linking and integration of elements is needed, and the sophistication of the demands for modelling, interpretation and generalisation in reaching and justifying a solution. The PISA tasks vary from single-step problems requiring students to reproduce basic mathematical knowledge or carry out simple computations, to complex multi-step problems requiring insight, generalisation and/or mathematical modelling in unfamiliar contexts.

Proficiency levels in mathematical literacy are not defined in PISA 2000, but tasks of low, medium and high difficulty are described.

By way of example, students with a very high level of proficiency in mathematical literacy (with scores of around 700 or more scale points) typically could interpret and formulate problems in mathematical terms, handle several processing steps, apply appropriate tools and knowledge, use insight in finding a suitable solution to a problem and employ high order thinking and communicating skills to explain their results. Only a small percentage of students achieved scores at or above this level in PISA 2000.

Highest described level

Show insight in the solution of problems.

Develop a mathematical interpretation and formulation of problems set in a real world context.

Identify relevant mathematical tools or methods for solution of problems in unfamiliar contexts.

Solve problems involving several steps.

Reflect on results and generalise findings.

Use reasoning and mathematical argument to explain solutions and communicate outcomes.

Middle described level

Interpret, link and integrate different information in order to solve a problem.

Work with and connect different mathematical representations of a problem.

Use and manipulate given mathematical models to solve a problem.

Use symbolic language to solve problems.

Solve problems involving a small number of steps.

Lowest described level

Recognise familiar elements in a problem, and recall knowledge relevant to the problem.

Reproduce known facts or procedures to solve a problem.

Apply mathematical knowledge to solve problems that are simply expressed and either already formulated in mathematical terms, or where the mathematical formulation is straightforward.

Solve problems involving only one or two steps.

Figure 4.1 Levels on the PISA Mathematical Literacy Scale

Students with a medium level of proficiency (with scores around 570 scale points) typically could bring together and process different pieces of information (sometimes expressed algebraically and sometimes represented in different ways), work with given strategies or models to solve problems, check the validity of given models and apply appropriate mathematical knowledge to solve problems with a small number of processing steps.

Students demonstrating a very low level of proficiency on the PISA mathematical literacy scale (with scores of around 380 scale points or less) could usually cope with only a single processing step, consisting of reproducing basic mathematical facts or processes, recognising familiar information presented in straightforward diagrams or carrying out simple computations.

Summary descriptions of high, medium and low levels of proficiency on the PISA mathematical literacy scale are provided in Figure 4.1. These descriptions will be reviewed and elaborated for reporting the PISA 2003 results, when mathematics is the major assessment domain. Meanwhile the levels are indicative only, with no clear-cut boundaries specified between them. Students were therefore not assigned proficiency levels in mathematical literacy in the same way as they were for reading literacy.

Some sample PISA mathematical literacy items and responses are presented below to give meaning to the levels described in Figure 4.1.

>> *Sample mathematics items*

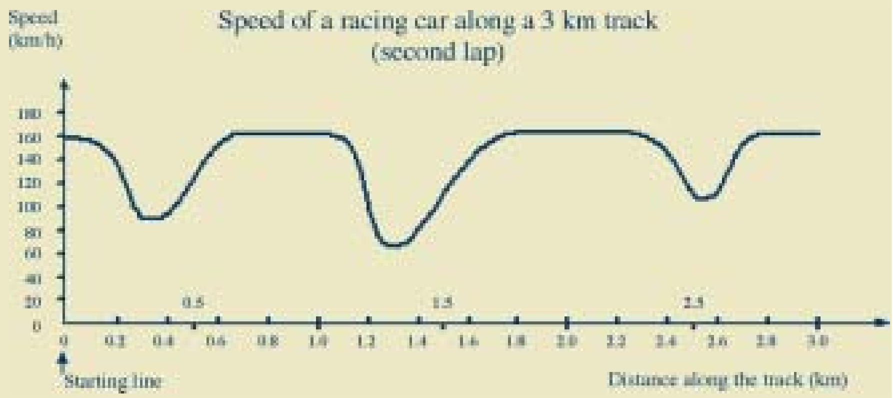
The tasks used to assess mathematical literacy in PISA are wide-ranging, especially in terms of their difficulty. The tasks are presented in 'units', usually with two or more items relating to a piece of text or a diagram accompanied by text. Only a small number of the mathematics items has been released for use in reports of PISA 2000 results, as most need to be kept secure for linking to later cycles. The sample items included here have been chosen to illustrate various aspects of the framework, different item types and the range of complexity involved in the tasks. It is easy to see from the items that tasks at the higher end of the mathematical literacy scale require very different skills from those at the lower end. Tasks become more difficult as they require more processing steps, more connections to be made between different elements, more manipulation of abstract terms and more understanding in order to be able to explain solutions obtained. A table of results for Australia and some other countries on the illustrated items is provided following the presentation of the items.

SPEED OF RACING CAR

Some of the items relating to the following text and graph were among the easiest in the test for the OECD as a whole.[2] The items, all in multiple choice format, belong to the functions strand of mathematics and fall within the main area of growth and change. The situation is specified as scientific. To answer the items successfully, students needed to be able to read the graph, interpret the physical relationship shown and relate this to the diagrams of the racing circuit.

[2] References to the 'OECD as a whole' mean to the 28 OECD member countries that took part in PISA 2000 (see Chapter 1).

This graph shows how the speed of a racing car varies along a flat 3 kilometre track during its second lap.



It needs to be noted here that some items quite similar to the Racing Car set are featured in mathematics textbooks used in both the United Kingdom and Australia, and possibly other countries as well. The items were retained for use in the PISA test after analyses of field trial data showed no evidence of unusually good or poor performance on these items by any country.

The first item, which is located at close to 500 on the mathematical literacy scale, is of medium difficulty. It requires students to interpret the graph to find the distance that satisfies a given condition and then to read the approximate distance correctly from the graph. (Note that the set of answers provided would have discouraged students who thought that the 'longest straight section' of the track began where the line becomes straight – an answer option of '1.7 km' could have been useful here for diagnostic purposes.)

Racing Car Question 1

What is the approximate distance from the starting line to the beginning of the longest straight section of the track?

A 0.5 km
B 1.5 km
C 2.3 km
D 2.6 km

The example above is a Competency Class 2 item because it requires linking of several elements – the verbal description with the graph plus an understanding that a straight stretch is where the graph will show a period of acceleration followed by constant speed. Another item in this unit, shown here as Question 2, is a Class 1 item because it requires only that students recognise the lowest point on the graph and read off the corresponding distance on the horizontal axis. This item, the difficulty of which corresponds to about 400 scale score points, is one of the easiest in the test.

Racing Car Question 2

Where was the lowest speed recorded during the second lap?

A. at the starting line
B. at about 0.8 km
C. at about 1.3 km
D. halfway around the track

Another easy item, also a Class 1 item, requires a slightly higher level of understanding of what the graph shows, but is still relatively straightforward. It is shown here as Question 3.

Racing Car Question 3

What can you say about the speed of the car between the 2.6 km and 2.8 km marks?

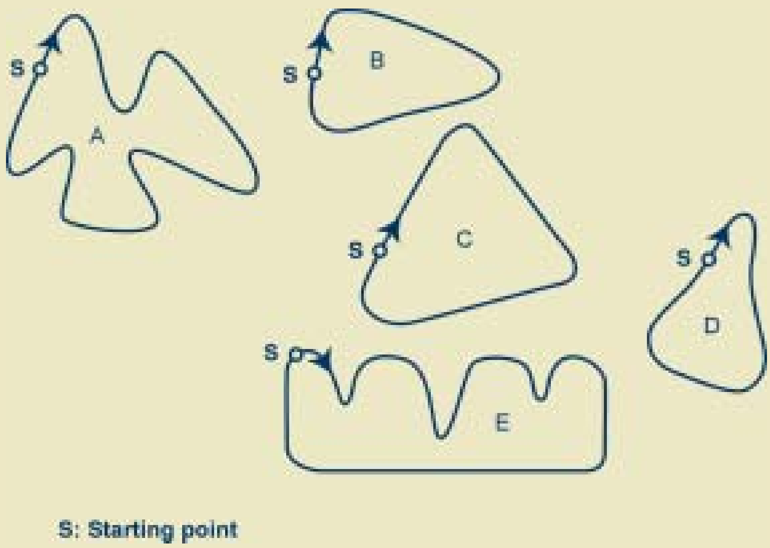
A. The speed of the car remains constant.
B. The speed of the car is increasing.
C. The speed of the car is decreasing.
D. The speed of the car cannot be determined from the graph.

The final Racing Car item, Question 4, is still categorised as involving Competency Class 2 processes, but is much more difficult (over 650 scale score points) than the other three items in the unit. It requires a deeper understanding of what the graph represents, plus interpreting the given track diagrams and relating them to the graph. The correct answer is 'B'.

Racing Car Question 4

Here are pictures of five tracks:

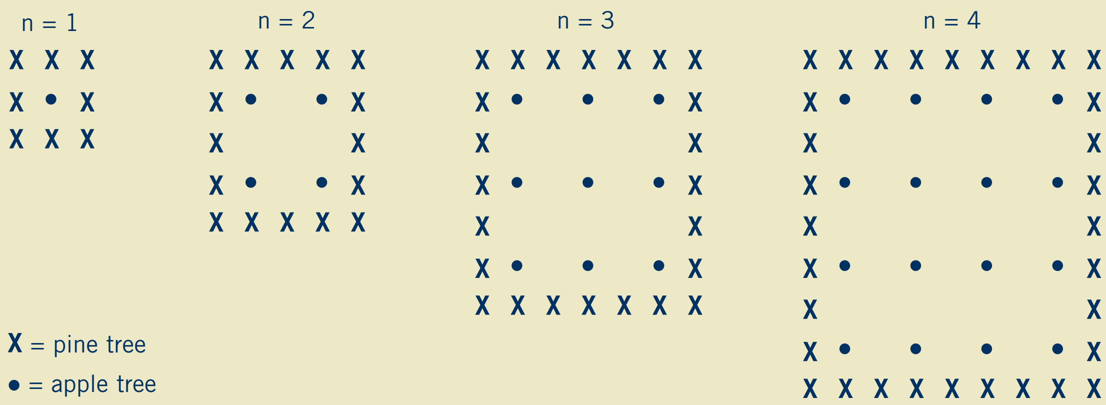
Along which one of these tracks was the car driven to produce the speed graph shown earlier?



APPLES

The unit ‘Apples’ presents a scenario where a farmer is planting an orchard of apple trees in a square grid, with a border of conifers (referred to as ‘pine trees’ in the Australian version of the test) around it for shelter from the wind. The first two items in the unit are Competency Class 2 items while the third is Class 3. Students found this unit considerably harder than the Racing Car unit. The unit’s situation is classified as educational, with the items coming from the algebra strand of mathematics in the area of growth and change.

A farmer plants apple trees in a square pattern. In order to protect the trees against the wind he plants pine trees all around the orchard.
Here you see a diagram of this situation where you can see the pattern of apple trees and pine trees for any number (n) of rows of apple trees :



X = pine tree
• = apple tree

The first question asks students to extrapolate from the diagrams given and complete a table to show how the numbers of apple trees and conifers increase as the size of the orchard is increased. Not only did students have to interpret the written description and understand the illustrated pattern, but they also then had to extend the pattern and successfully complete a table following the two relationships through as the number of rows increases.

Apples Question 1

Complete the table

n	Number of apple trees	Number of pine trees
1	1	8
2	4	16
3	9	24
4	16	32
5	25	40

n=8
apple = 64 → n^2
pine = 64 → n×8

To earn a mark for this question, all entries in the table had to be correct, as in the above response. (In the working shown outside the table, this student was anticipating the next question.) It was originally intended that answers such as the following would be marked as partially correct. However, students who could do the question usually had it fully correct and the item was found to 'behave' better in statistical analyses of item properties if only fully correct answers were given credit. This item is of medium difficulty (about 550 score points).

Complete the table

n	Number of apple trees	Number of pine trees
1	1	8
2	4	16
3	9	24
4	16	32
5	24	40

The second item provides two algebraic expressions to describe growth in numbers of the two kinds of trees as the number of rows increases. The students were asked to find the value of 'n' for which the number of apple trees would equal the number of conifers. A mark was awarded for the correct answer, '8', whether or not a clear algebraic solution was presented. Some students reached their answer by continuing the table in the first question, some used trial and error and some extended the pattern by drawing diagrams. Some students who used a purely algebraic strategy arrived at two solutions for n, 8 and 0, which was marked as correct if both numbers were given in the answer. However, an answer of 0 without 8 as well was not given credit. This item has a difficulty value of 665 score points. Some sample answers follow.

Apples Question 2

There are two formulae you can use to calculate the number of apple trees and the number of pine trees for the pattern described above:

Number of apple trees = n^2

Number of pine trees = $8n$

where n is the number of rows of apple trees.

There is a value of n for which the number of apple trees equals the number of pine trees. Find the value of n and show your method of calculating this.

value of n is 8. WorKed out because

8 x 8 is the same as 8^2.

n = 8, I saw that 4n = 16 apple & 32 pine so guessed that doubling n (8n) would give the answer, which it did. $8^2 = 64$

$8 \times 8 = 64$

The following student did not set up the algebraic expression correctly and made further errors in attempting to solve it. While mathematical expressions often have no connection with reality, the student's response in this case, where there is a real-world connection, also illustrates what can happen when students manipulate expressions without thinking about the underlying meaning of what they are doing – in this case, supposedly finding a number of trees. Arriving at a solution which would result in numbers of trees to many decimal places should have triggered a warning bell (or possibly it did, and the student did not know how to correct the equation).

$8^2 = 1^2 \times n^2$

$64 = 1 \times n^2$

$n^2 = 64 - 1$ $\quad n = \sqrt{63}$

$n^2 = 63$ $\quad n = 7.937$ (3 decimal places)

The final item in the unit on Apples requires a deeper level of understanding of the relationships given in the formulae in the second item. To give a complete answer, students had to show insight into mathematical functions by comparing growth expressed as a linear function with growth expressed as a quadratic function. A complete answer, such as the first two examples shown below, was awarded two points. To achieve full credit, students had to provide the correct answer as well as a justifiable explanation. At more than 720 points on the mathematical literacy scale in difficulty, this item is one of the hardest in the test. Given the levels of analysis and insight required in providing a correct answer, the item is classified as belonging to Competency Class 3. It was possible to earn one point for a partially correct response, which corresponds to a difficulty of 672 points on the scale. An example of a partially correct answer is also included here.

Apples Question 3

These responses earned full credit of two points:

Suppose the farmer wants to make a much larger orchard with many rows of trees. As the farmer makes the orchard bigger, which will increase more quickly: the number of apple trees or the number of pine trees? Explain how you found your answer.

The number of apple trees will increase more quickly because that number, say 30, will be squared and so increase quicker than 8 x 30. The next sequence could be 31, and this times itself will give an ever increasing no. than something always multiplied by 8 which will obviously only go up 8 each time.

The number of apple trees would increase faster because its square (n^2) not just multiplied ($8n$).

while the next one earned one point. The student had a sense of what would happen and correctly identified that the number of apple trees would increase more quickly, but expressed the answer in too vague a way to be marked as fully correct.

The number of ~~a~~ apples trees because ~~of~~ the number of apples trees more than doubles each time get bigger while only pine trees get added each time it bigger.

The student in the following example had little understanding of the scenario and was awarded a mark of zero for this response:

If the farmer was to make a larger orchara I believe the pine trees would increase more. The reason for this is the pine trees started with ~~more~~ 8 and apples with one. So when the farmer made ~~these~~ bigger the pine trees ~~g~~ increased more than apple trees.

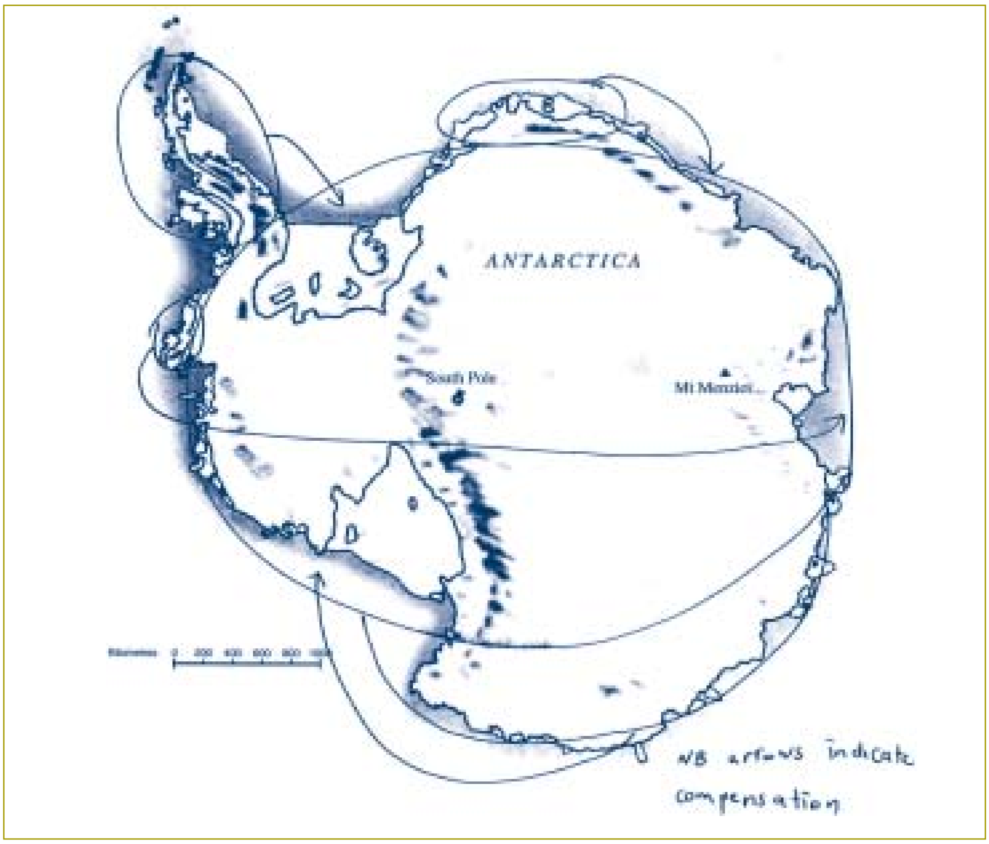
CONTINENT AREA

Continent Area Question 1

In a 'measurement' item from the space and shape section, a map of Antarctica is shown and students are asked to estimate the continent's area. They are encouraged to draw on the map to help them arrive at their answer. The item is a Competency Class 2 item given that it requires several steps, including interpretation of the map scale, determining an appropriate strategy for estimating the area and then carrying out the estimation. The estimation is not straightforward, as it requires a strategy for coping with the irregular shape, then correctly applying a formula and not going astray in working with relatively large numbers. The item, as an estimation item, does not call for a precise answer – trying to provide a precise answer, had it been possible to work one out, would have been a misguided strategy. As stated earlier, students were permitted to use calculators if they wished, and Test Administrators carried spares for students who forgot to bring their own.

Students used an interesting variety of methods. Answers in the range 12 million to 18 million square kilometres were given full credit (two points). Answers in the millions but outside this range earned a single point, as did answers that would have been in the range had the students included the correct number of zeroes (arriving at the correct order of magnitude is regarded as an important estimation skill). Answers where the scale units (cm) were used rather than km, provided that the method used was shown, were also assessed as partially correct.

The following example shows a thorough approach to the exercise, using the area of a circle as starting point.



But, unfortunately, the student began with an incorrect formula, and so was only able to be given one mark.

Estimate the area of Antarctica using the map scale.

Show your working and explain how you made your estimate. (You can draw over the map if it helps you with your estimation.)

It can be roughly estimated using the area of a circle, radius 2200 km with a center about in the middle of the continent.

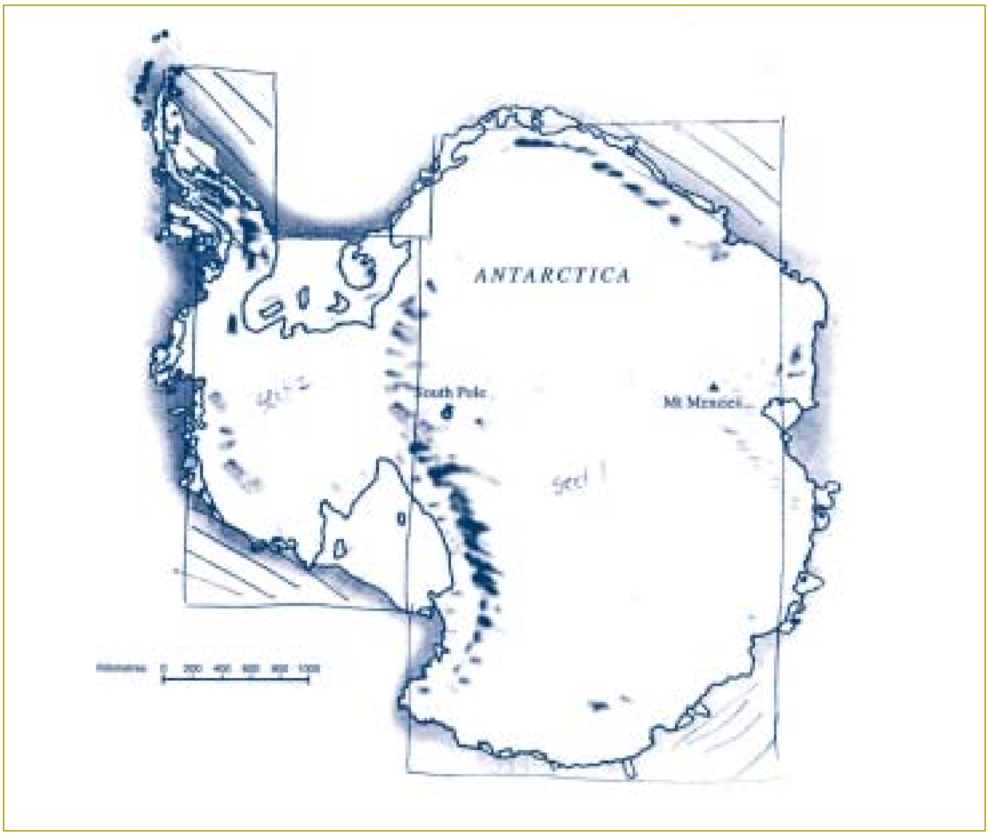
$2\pi r^2$ = Area of a circle

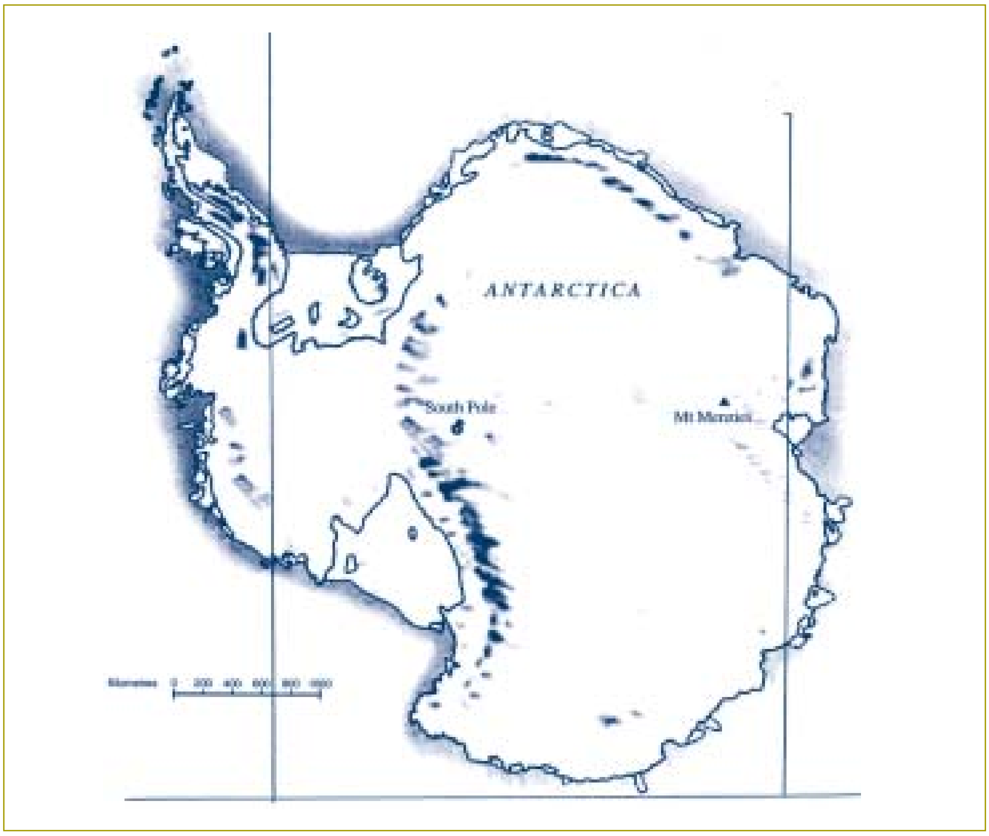
$2 \cdot \pi \cdot 2200^2$ = Area of continent (estimate)

= 30'410'616.89 km^2

I estimate the continent's area to be 30.4 million km^2

The following two students earned full credit for their answers. Only the second one's working is shown.





drew an approximate rectangle over the continent then estimated the length and width then timesed them together to find the area.

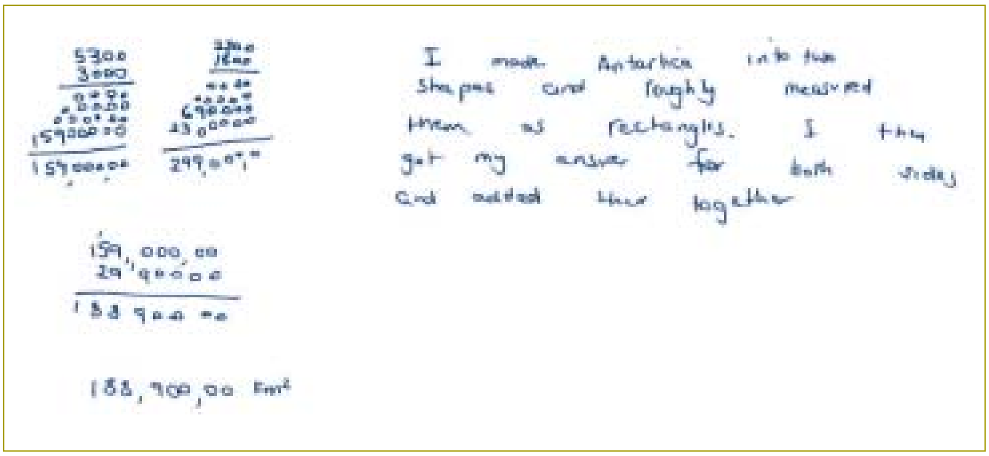
```
  3400
× 4850
------
  0000
170000
2720000
13600000
--------
1649 0000
```

Area = L × W

```
=  3400
  ×4850
-------
   0000
 170000
2720000
13600000
```

Answer: 16,490,000 km

Many students lost marks because of numerical mistakes. The student in the next response made an error in the second multiplication, then put the commas in the wrong place to indicate millions and thousands (though partly compensated for this when adding the two results), had the commas incorrectly placed in the first multiplication and persisted with the incorrect placing in the answer. Using a calculator would probably have helped this student, provided that the millions and thousands were correctly read from the display.



Others did not read the question properly (or perhaps did not know the meaning of 'area'):

Estimate the area of Antarctica using the map scale.

Show your working and explain how you made your estimate. (You can draw over the map if it helps you with your estimation.)

perimeter of about 24 000km.

Results on the illustrated items

The percentages correct for selected countries on the illustrated items are shown in Table 4.2. It is interesting to note that Australia's result was usually above the OECD average on these items. It is also interesting that results by gender were either equivalent or slightly in favour of males, except for the last question of Racing Car (the one with several race track configurations shown), where there was a substantial difference. Further discussion of performance on the mathematics items is included near the end of the chapter.

Table 4.2 Selected Results (Percentages Correct) on Illustrated PISA Mathematics Items

	International			Australia		
	OECD average*	Highest country	Lowest country	All	Females	Males
Racing Car						
Question 1	67	82 (Iceland)	36 (Mexico)	75	71	79
Question 2	83	92 (Finland)	56 (Mexico)	91	90	91
Question 3	83	90 (Finland)	56 (Mexico)	89	86	92
Question 4	29	54 (Japan)	4 (Mexico)	36	27	43
Apples						
Question 1	50	82 (Japan)	27 (Mexico)	62	60	63
Question 2	25	61 (Korea)	9 (Mexico)	25	24	26
Question 3#	13	30 (Korea)	3 (Mexico)	19	17	21
Continent Area						
Question 1#	20	34 (Switzerland)	4 (Mexico)	27	24	29

* Countries were weighted equally in computing these statistics.
# These items were each worth two score points. The results shown are percentages weighted for the numbers of fully and partially correct answers.

High and low performance in mathematical literacy

Reference is made to some aspects of the distributions of mathematical literacy results in Chapter 2. We have seen earlier in the present chapter that cut-offs defining proficiency levels were not set for the mathematical literacy component of PISA. High and low achievers in this domain had to be identified in other ways. For example, the best five per cent of students internationally achieved 655 points on average across OECD countries, the best 10 per cent reached 625 points and the best 25 per cent, 571 points. The corresponding statistics for Australia were that the best five per cent achieved 679 points or more and the best 10 per cent and 25 per cent reached 647 points and 594 points, respectively. Two-thirds of the Australian students scored more than 500, the OECD average. At the lower end of the scale, three-quarters of the students internationally achieved on average at least 435 points, 90 per cent reached 367 points and 95 per cent, 326 points. Corresponding results for Australia were that three-quarters of the students achieved at least 474 points, 90 per cent scored 418 or more and 95 per cent scored 380 or more. The composition of the high and low achieving groups in Australia is examined and discussed in Chapter 9.

>> *PISA's coverage of scientific literacy*

As for mathematical literacy, scientific literacy results in PISA 2000 are reported on a single scale.[3] The distribution of science items is shown by framework aspect and item type in Table 4.3. The 35 items were worth a total of 39 score points. The aspects and item types are explained on the following pages.

[3] For uniformity with the discussion of mathematics in this chapter, the science content areas are listed first in the table, followed by the science processes, rather than in the order of priority they receive in the framework, which has science processes as the most important category.

Table 4.3 Classification of Assessment Items for the Scientific Literacy Scale

Framework aspect	Item type and number of items				
	Multiple choice	Closed constructed responses*	Open constructed responses	Short responses	Total
Distribution of items by science major area (content)					
Earth and environment	3	3	6	1	13
Life and health	6	1	5	1	13
Technology	4	4	1	-	9
Total	**13**	**8**	**12**	**2**	**35**
Distribution of items by science area of application (content)					
Atmospheric, chemical, physical, geological change	-	2	5	-	7
Biodiversity and ecosystems	3	-	1	-	4
Earth and universe	3	1	-	1	5
Energy transfer	-	2	2	-	4
Form and function	1	-	2	-	3
Genetic control	1	1	-	-	2
Human biology, physiological change	1	-	2	1	4
Structure of matter	4	2	-	-	6
Total	**13**	**8**	**12**	**2**	**35**
Distribution of items by science process#					
Communicating conclusions, evidence or data to others	-	-	3	-	3
Drawing or evaluating conclusions	1	3	3	-	7
Identifying evidence or data	2	1	2	-	5
Recognising questions	1	3	1	-	5
Demonstrating conceptual understanding	9	1	3	2	15
Total	**13**	**8**	**12**	**2**	**35**
Distribution of items by situation (context)					
Global	4	4	7	1	16
Historical	2	-	2	-	4
Personal	4	2	2	-	8
Public	3	2	1	1	7
Total	**13**	**8**	**12**	**2**	**35**

* Includes both complex multiple choice and closed constructed responses
# The first four processes are listed alphabetically to conform to the international report. They are presented in the reverse order in the framework.

As indicated in the table, the assessment framework for scientific literacy in PISA 2000 features similar broad dimensions to those in the framework for mathematical literacy: scientific content; scientific processes; and the contexts or situations in which the science assessment items are set. Scientific content is grouped both in major thematic areas and in areas of application more typical of curriculum topics. At another level, not shown, the items have also been classified in terms of the subject areas of physics/chemistry, biology and earth science. The numbers of items by subject area are: physics/chemistry, 13; biology, 13; Earth and space, 8. The classification by subject area closely corresponds, but is not identical, to the classification by science major area.

The framework aspects are described here in a little more detail than the reading aspects were in the previous chapter, given that there are no detailed descriptions of proficiency levels for scientific literacy in PISA 2000. Scientific literacy results will be reported on sub-scales as well as on the overall scientific literacy scale when science is the major domain.

Content

The PISA science framework, in similar fashion to the mathematics framework, is innovative in specifying content in terms of major thematic areas rather than within traditional subject boundaries such as physics, chemistry, biology and so on. Instead, the thematic areas of *science in Earth and environment*, *science in life and health* and *science in technology* are specified. These thematic areas are considered to be of more relevance to all people in their lives beyond school than the traditional subject areas, and therefore more in keeping with PISA's orientation towards preparedness for adult life.

The major areas of 'Earth and environment', 'life and health' and 'technology' were assessed in science in PISA 2000.

The coverage of topics within the major thematic areas will be extensive when science is the major domain in PISA 2006. Even so, the range of topics (referred to in the framework as *areas of application*) included in PISA 2000, when science was a minor domain, is reasonably broad-ranging, to the point where we can be confident that estimates of performance based on the shorter test in 2000 will be close to estimates that would have been obtained if the students had done a longer test. (The same is true for mathematics.) The PISA 2000 scientific literacy assessment included, in order of emphasis, items on atmospheric change, geological change, chemical and physical changes; structure of matter; Earth in the universe; biodiversity and ecosystems; human biology and physiological change; energy transformation; form and function; and genetic control.

Processes

The PISA science framework emphasises understanding of science concepts, knowledge of the nature of science and the ability to use scientific knowledge and reasoning. Four processes pertaining to scientific investigations are defined: recognising scientifically investigable questions; identifying evidence needed in a scientific investigation; drawing or evaluating conclusions in relation to the evidence available; and communicating valid conclusions drawn from the evidence available. The framework emphasises the nature of science because, in the view of the expert group, a sound understanding of the principles and procedures of scientific investigations, and the strengths and limitations of these, will be important to today's students in their future lives as societies become increasingly affected by scientific and technological advances.

Understanding of processes involved in carrying out scientific investigations was assessed ….

Apart from the four processes defined in relation to scientific investigations, a fifth process, demonstrating understanding of scientific concepts, is an important element of the PISA science framework. This process involves showing understanding through being able to apply concepts in non-school situations, perhaps to explain an event or perhaps to predict an event. This fifth process is an overarching one in that the first four processes are only described as scientific processes if they are applied in relation to scientific content. Items to measure the first four processes were designed so that the conceptual knowledge required was kept to a moderate level.

…. as well as understanding of important scientific concepts.

Situations and contexts

PISA emphasises the application of scientific processes and concepts in relation to problems and issues in the real world. The situations in which the assessment items are set relate to real-world phenomena in which science can be applied for human benefit (preventing further damage to the ozone layer, for example). Some areas in which science is applied have been under investigation for more than a hundred years, providing opportunities to evaluate changes in scientific understanding over time and for recognising the application of science in situations that seem strange today. Thus, historical situations are included among those in which PISA science items are set. Other situations are categorised in the framework as personal, community and global, depending on their closeness to the students' lives.

Types of assessment items

As in the other domains, the framework categories for scientific literacy are assessed through a range of item types. Some science items in PISA 2000 were multiple choice; some were described as 'complex multiple choice' (mostly requiring a series of True/False or Yes/No answers within the item); some, referred to as 'closed constructed response', required recall of knowledge or minimal working leading to a clear-cut short answer; and some, referred to as 'open constructed response', required extended working and explanation of the response given. There were also two science items requiring only short answers to be provided, but the items are shown in a separate category because the answers were not as clear-cut as those for the closed constructed response items. Almost all the items were presented in units, with two or more items pertaining to stimulus text and/or diagrams.

The distribution of item types is shown in Table 4.4,[4] cross-tabulated with the framework categories. Several of the science processes can best be assessed by items in the open constructed response category, but, following the framework specification, the number of items in this category was limited to one-third of the total number.

>> *Students' proficiency in scientific literacy*

As for the other domains, the PISA 2000 scientific literacy scale was constructed to have a mean of 500 and a standard deviation of 100 across the OECD countries, with each country contributing equally to the scaling. Based on only one hour of assessment time for science as a minor domain, there was insufficient information to define five levels of proficiency in the same way as was done for reading. It was

[4] In the table, complex multiple choice items have been grouped together with closed constructed response items.

possible, however, to distinguish characteristics of tasks at low, medium and high levels of difficulty on the scale and to describe high, medium and low levels of students' proficiency in relation to the groups of tasks. Detailed proficiency levels will be established when science is the major assessment domain in 2006.

Proficiency levels in scientific literacy are not defined in PISA 2000, but tasks of low, medium and high difficulty are described.

The more difficult scientific literacy tasks compared with the easier tasks tend to feature more complex concepts and more data, while requiring more connections to be made between different components of the task, more reasoning steps and more precise communication of explanations or conclusions. PISA's scientific literacy tasks in 2000 require, in increasing order of difficulty, recall of simple scientific knowledge or common science knowledge or data; science concepts or questions and aspects of investigations; elaborated science concepts or additional information or several steps in a chain of reasoning; and simple conceptual models or evidence for alternative perspectives.

The three proficiency levels described for PISA 2000 are included, together with a list of the requirements of tasks at each level, in Figure 4.2.

Highest described level

Create or use simple conceptual models to make predictions or give explanations.

Analyse scientific investigations in relation to, for example, experimental design or identification of idea being tested.

Relate data as evidence to evaluate alternative viewpoints or different perspectives.

Communicate scientific arguments and/or descriptions in detail and with precision.

Middle described level

Use scientific concepts in making predictions or giving explanations.

Recognise questions that can be answered by scientific investigation and/or identify details of what is involved in a scientific investigation.

Select relevant information from competing data or chains of reasoning in drawing or evaluating conclusions.

Lowest described level

Recall simple scientific factual knowledge (e.g. names, facts, terminology or simple rules).

Use common science knowledge in drawing or evaluating conclusions.

Figure 4.2 Levels on the PISA Scientific Literacy Scale

Tasks towards the top end of the scale, in the highest described region, were placed at about 690 scale points; tasks classified as 'medium' were placed at about 550 points; and tasks towards the lower end of the scale, in the lowest of the three described regions, were placed at about 400 points. These levels are indicative only, as precise cut-off scores to define levels will not be established until science is the major assessment domain. Students were therefore not assigned proficiency levels in the same way as they were for reading literacy.

Some sample PISA scientific literacy items and responses are presented below, to give meaning to the levels described in Figure 4.2.

Sample science items

The tasks used to assess scientific literacy in PISA are wide-ranging in many respects, including the spread of difficulty of the items. As for mathematical literacy, only a small number of items has been released for use in reports – most need to be kept for linking to later cycles. The sample items included in this chapter were chosen to show various aspects of the framework, different item types and the range of difficulty involved in the tasks. A table of results for Australia and some other countries on the illustrated items is included following the presentation of the items.

Some of the sample science items, the first and third examples for the Semmelweis unit, are used here to illustrate another feature of the PISA data. Instead of single-digit marks indicating degrees of correctness of responses to open-ended items, as was done for reading, two-digit codes were used for this kind of item in mathematics and science. In some cases the second digit yields information about various methods used by students in providing their answers, in other cases it identifies which concept(s) the students have drawn on. Where answers are incorrect, the second digit can pinpoint alternative conceptions and the incidence with which they occur. This kind of coding scheme was originally proposed by Norway and was used in TIMSS as well as in PISA. Although no analysis of these codes is included in the international PISA report or this Australian report, the codes have potential for use in more detailed research on student learning, and for derivation of information on misconceptions that could be useful for diagnostic purposes.

SEMMELWEIS

The unit 'Semmelweis' refers to research in the mid 19th century on causes of puerperal fever. Semmelweis, a Hungarian doctor, was alarmed at the death rate from this disease in one ward of a hospital. The unit presents two brief extracts from Semmelweis's diary together with a graph of deaths in two maternity wards over several years. One of the diary entries contains the statement that 'for centuries science has told us that … causes may be changes in the air or some extraterrestrial influence or a movement of the earth itself, an earthquake'. Then the following piece of text is presented:

Nowadays not many people would consider extraterrestrial influence or an earthquake as possible causes of fever. We now know it has to do with hygienic conditions. But in the time Semmelweis lived, many people, even scientists, did! However, Semmelweis knew that it was unlikely that fever could be caused by extraterrestrial influence or an earthquake. He pointed at the data he collected and used this to try to persuade his colleagues.

The students are referred to the graph and are then asked to imagine that they are Semmelweis and use his data to support the argument that earthquakes are unlikely to be the cause of the disease, as follows.

Semmelweis Question 1

Suppose you were Semmelweis. Give a reason (based on the data Semmelweis collected) why puerperal fever is unlikely to be caused by earthquakes.

A fully correct answer to this question was worth two marks. One mark was awarded for partially correct answers, which typically stated something reasonable but did not refer to Semmelweis's data. Part of the Marking Guide for this question is included here to illustrate the nature of the marking criteria. It also illustrates the way that mathematics and science items in PISA were marked with two-digit codes, the first code indicating degree of correctness and the second code indicating the type of response given.

FULL CREDIT

Score 2(1): Answers which refer to the difference between the number of deaths (per 100 deliveries) in both wards, for example:

- Due to the fact that the first ward had a high rate of women dying compared to women in the second ward, obviously shows that it had nothing to do with earthquakes.
- Not as many people died in ward 2 so an earthquake couldn't have occurred without causing the same number of deaths in each ward.
- Because the second ward isn't as high, maybe it had something to do with ward 1.
- It is unlikely that earthquakes cause the fever since death rates are so different for the two wards.

PARTIAL CREDIT

Score 1(1): Answers which refer to the fact that earthquakes don't occur frequently, for example:

- It would be unlikely to be caused by earthquakes because earthquakes wouldn't happen all the time.

Score 1(2): Answers which refer to the fact that earthquakes also influence people outside the wards, for example:

- If there were an earthquake, women from outside the hospital would have got puerperal fever as well.
- If an earthquake were the reason, the whole world would get puerperal fever each time an earthquake occurs (not only the wards 1 and 2).

Score 1(3): Answers which refer to the thought that when earthquakes occur, men don't get puerperal fever, for example:

- If a man were in the hospital and an earthquake came, he didn't get puerperal fever, so earthquakes cannot be the cause.
- Because girls get it and not men.

Answers scored as incorrect included only that earthquakes cannot cause fever (e.g., ‘An earthquake cannot make a person sick’); answers stating only that the fever must have another cause (e.g., ‘Earthquakes do not let out poison gases’, ‘They have nothing to do with each other, it’s just superstition’); answers with a combination of these reasons (e.g., ‘The death is caused by bacteria and the earthquakes cannot influence them.’); and other miscellaneous answers such as ‘Because there weren’t any earthquakes and they still got it.’

The following response was awarded full credit (grammatical mistakes were not penalised):

> Suppose you were Semmelweis. Give a reason (based on the data Semmelweis collected) why puerperal fever is unlikely to be caused by earthquakes
>
> If it were caused by earthquakes, the
> lines of Ward1 and Ward2 would be
> much more simlar as earthquakes
> would of affected both wards

The following two responses were each awarded one point – the first was coded ‘11’ and the second was coded ‘12’, in accordance with the Marking Guide. (Spelling mistakes were not penalised either.)

> Women die of it continually not just
> when their are earthquakes, if it was
> caused by earthquakes women would
> only die when there were earthquakes.

> Because the movment of the earth
> can effect any one on earth But in
> other parts of the world there are not many
> mother dies with the fever

The final sample response to this item was marked incorrect.

> Because he said they all had pneumonia

The student who offered this response was sidetracked by the comment in Semmelweis’s diary that ‘Giving birth … is as dangerous as first-degree pneumonia.’

A fully correct answer to this question was difficult to achieve, being placed at 666 on the scientific literacy scale. It was also quite difficult to gain one score point – a partially correct answer was placed at 638 on the scale.

The second question in the Semmelweis unit asks students to identify, from clues in the diary entries and accompanying text, what Semmelweis was thinking about how to reduce the incidence of puerperal fever. The question requires students to evaluate the information given and to use relevant pieces of it (about medical students' behaviour and the death of a friend of Semmelweis from puerperal fever after he had cut himself during a dissection) to draw a conclusion. This item, shown below, was placed at 493 on the scientific literacy scale and is an example of items at a medium level of difficulty.

Semmelweis Question 2

Semmelweis' new idea had to do with the high percentage of women dying in the maternity wards and the students' behaviour.

What was this idea?

A Having students clean themselves after dissections should lead to a decrease of puerperal fever.

B Students should not take part in dissections because they may cut themselves.

C Students smell because they do not clean themselves after a dissection.

D Students want to show that they are industrious, which makes them careless when they examine the women.

Question 3 asks students to use common scientific knowledge that heat generally kills bacteria to explain why some measures taken in hospitals are effective. This item, at 467 points on the scientific literacy scale, is an example of items of low to moderate difficulty. The item was worth one mark, but, in accordance with the Marking Guide, five different codes were used to show the types of answers supplied. The following three responses were each marked correct, but given different second codes according to their different foci – on killing bacteria, removing (rather than killing) germs (reference to 'germs' was assigned a different code from 'bacteria'), and the specific reference to 'sterilising'.

Semmelweis Question 3

Semmelweis succeeded in his attempts to reduce the number of deaths due to puerperal fever. But puerperal fever even today remains a disease that is difficult to eliminate.

Fevers that are difficult to cure are still a problem in hospitals. Many routine measures serve to control this problem. Among those measures are washing sheets at high temperatures.

Explain why high temperature (while washing sheets) helps to reduce the risk that patients will contract a fever.

Because high temperature kills many types of harmful bacterias

Because the heat and steam will get rid OF the germs

Because you can sterelize things by washing them in Boiling water.

The final sample response to Question 3 was scored zero. It reflects a common misconception about how people contract fevers, and the word ‘clean’ was considered too vague to be credited as showing understanding of a scientific concept.

they will not get a fever because the sheets are clean & warm

The last question in the Semmelweis unit is another item of average difficulty (placed at 508 on the scale). It also requires students to show understanding of a scientific concept (why antibiotics have become less effective over time) in order to recognise an explanation, but is harder than Question 3 because, for students, it goes beyond common knowledge. The item illustrates an interesting use of a historical context as a springboard for having students think about a similar phenomenon at the present time.

Semmelweis Question 4

Many diseases may be cured by using antibiotics. However, the success of some antibiotics against puerperal fever has diminished in recent years.

What is the reason for this?

A Once produced, antibiotics gradually lose their activity.

B Bacteria become resistant to antibiotics.

C These antibiotics only help against puerperal fever, but not against other diseases.

D The need for these antibiotics has been reduced because public health conditions have improved considerably in recent years.

OZONE

Only two of the thirteen scientific literacy units used in PISA 2000, Semmelweis and Ozone, have been released. The Ozone unit presents a short article from a UNESCO Newsletter, shown below. There are four questions in the unit, which are presented here in order of increasing difficulty rather than in the order they appear in the assessment booklet (and hence are labelled differently). The first two are of medium difficulty, at 529 and 547 points on the scientific literacy scale, respectively, while the third is more difficult, at 642 points. Providing a fully correct answer to the fourth question is among the hardest tasks in the assessment, with a difficulty of 682 points. This set of sample items illustrates four item types: complex multiple choice, short response, multiple choice and open constructed response.

OZONE

The atmosphere is an ocean of air and a precious natural resource for sustaining life on the Earth. Unfortunately, human activities based on national/personal interests are causing harm to this common resource, notably by depleting the fragile ozone layer, which acts as a protective shield for life on the Earth.

Ozone molecules consist of three oxygen atoms, as opposed to oxygen molecules which consist of two oxygen atoms. Ozone molecules are exceedingly rare: fewer than ten in every million molecules of air. However, for nearly a billion years, their presence in the atmosphere has played a vital role in safeguarding life on Earth. Depending on where it is located, ozone can either protect or harm life on Earth. The ozone in the troposphere (up to 10 kilometres above the Earth's surface) is "bad" ozone which can damage lung tissues and plants. But about 90 percent of ozone found in the stratosphere (between 10 and 40 kilometres above the Earth's surface) is "good" ozone which plays a beneficial role by absorbing dangerous ultraviolet (UV-B) radiation from the Sun.

Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun. In the last decades the amount of ozone has decreased. In 1974 it was hypothesised that chlorofluorocarbons (CFCs) could be a cause for this. Until 1987, scientific assessment of the cause-effect relationship was not convincing enough to implicate CFCs. However, in September 1987, diplomats from around the world met in Montreal (Canada) and agreed to set sharp limits to the use of CFCs.

The first example shown here from the Ozone unit (which was the fourth item in the assessment booklet) required students to understand the nature of questions that can be investigated with scientific methods, and is also an example of the complex multiple choice format. Both parts of the question had to be answered correctly for the response to be marked correct.

First Ozone example

At the end of the text, an international meeting in Montreal is mentioned. At that meeting lots of questions in relation to the possible depletion of the ozone layer were discussed. Two of those questions are given in the table below.

Which of the questions below can be answered by scientific research?

Circle Yes or No for each.

Question:	**Answerable by scientific research?**
Should the scientific uncertainties about the influence of CFCs on the ozone layer be a reason for governments to take no action?	Yes / No
What would the concentration of CFCs be in the atmosphere in the year 2002 if the release of CFCs into the atmosphere takes place at the same rate as it does now?	Yes / No

The second Ozone example requires a relatively clear-cut short response, such as 'skin cancer' or 'melanoma'. Responses indicating other forms of cancer, or merely stating 'cancer', were not marked correct.

Second Ozone example

Lines 14 and 15 state: "Without this beneficial ozone layer, humans would be more susceptible to certain diseases due to the increased incidence of ultra-violet rays from the Sun."

Name one of these specific diseases.

The third example from the Ozone unit is a multiple choice item, though it is structured in a somewhat unusual way. There is only one correct answer, but both columns of the table need to be considered to locate it. The item requires students to draw a conclusion from information supplied, but not stated directly, in the article. It is more difficult than the first two examples because it involves making inferences from the information given and also calling on common knowledge that thunderstorms usually occur relatively close to Earth.

Third Ozone example

Ozone is also formed during thunderstorms. It causes the typical smell after such a storm. In lines 9-13 the author of the text distinguishes between "bad ozone" and "good ozone".

In terms of the article, is the ozone that is formed during thunderstorms "bad ozone" or "good ozone"?

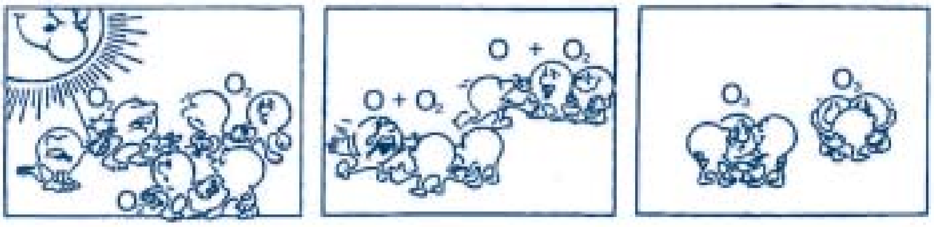
Choose the answer and the explanation that is supported by the text.

	Bad ozone or good ozone?	**Explanation**
A	Bad	It is formed during bad weather.
B	Bad	It is formed in the troposphere.
C	Good	It is formed in the stratosphere.
D	Good	It smells good.

The final Ozone example presents additional information in an innovative way, through a comic strip. The item is a difficult one, requiring students to understand the concept illustrated in the comic strip and then to explain it to their uncle using appropriate words. The predominant process involved is 'communication'. Initially this item was intended to be worth three marks for a fully correct answer, but the scoring was changed to one or two marks after preliminary analyses showed that marks of two and three were very close together on the scientific literacy scale.

Fourth Ozone example

In the text above nothing is mentioned about the way ozone is formed in the atmosphere. In fact each day some ozone is formed and some other ozone disappears. The way ozone is formed is illustrated in the following comic strip.



Suppose you have an uncle who tries to understand the meaning of this strip. However, he did not get any science education at school and he doesn't understand what the author of the strip is explaining. He knows that there are no little fellows in the atmosphere but he wonders what those little fellows in the strip stand for, what those strange notations O, O_2 and O_3 mean and which processes the strip represents. He asks you to explain the strip. Assume that your uncle knows:

A that O is the symbol for oxygen;
B what atoms and molecules are.

Write an explanation of the comic strip for your uncle.

In your explanation, use the words atoms and molecules in the way they are used in lines 5 and 6.

To be awarded two marks, students had to use the words 'atoms' and 'molecules' as instructed, and to mention at least two of the following aspects illustrated in the strip:

1) an oxygen molecule or some oxygen molecules are splitting into oxygen atoms (first frame)
2) the splitting takes place under the influence of sunlight (first frame)
3) the oxygen atoms combine with other oxygen molecules to form ozone molecules (second and third frames).

A score of one mark was of moderate to high difficulty, being placed at 628 on the scale, while a score of two, placed at 682 as mentioned earlier, was in the region of highest described difficulty on the scale.

The first sample response earned two marks:

When the sun beats down on oxygen molecules they are harmed by/destroyed by the sun. An oxygen molecule consists of only 2 oxygen atoms (O_2). But when an oxygen molecule joins with another oxygen atom an ozone molecule is formed & together they can lessen some of the Suns force on them & the earth.

while the next response earned only one mark:

Well firstly there are two oxygen atoms, which is represented by O_2. Another oxygen atom combs with them to make an ozone molecule, which is represented by O_3. Every day ozone is formed like this and other ozone disappears.

and the next one was scored zero for failing to mention any of the three aspects accurately.

Write an explanation of the comic strip for your uncle.

In your explanation, use the words atoms and molecules in the way they are used in lines 5 and 6.

The oxygen molecules and Atoms are spliting into separate groups of three

Results on the illustrated items

The percentages correct for selected countries on the illustrated science items are shown in Table 4.4. Results by gender, in contrast to mathematics, are either equivalent or slightly in favour of females, though there is a substantial difference on some items. Australia's results on PISA science items are discussed further in the next section.

Table 4.4 Selected Results (Percentages Correct) on Illustrated PISA Science Items

	International			Australia		
	OECD average*	Highest country	Lowest country	All	Females	Males
Semmelweis						
Question 1#	25	42 (Korea)	7 (Mexico)	25	29	22
Question 2	64	82 (Korea)	38 (Mexico)	70	74	65
Question 3	68	85 (Finland)	46 (Mexico)	70	78	63
Question 4	60	79 (Finland)	30 (Mexico)	63	64	62
Ozone						
First example	57	66 (UK)	36 (Portugal)	59	62	56
Second example	55	74 (Korea)	36 (Mexico)	60	62	58
Third example	35	60 (Japan)	24 (Denmark, Luxembourg)	43	43	43
Fourth example#	28	38 (Hungary)	15 (Mexico)	34	37	31

* Countries were weighted equally in computing these statistics.
\# These items were each worth two score points. The results shown are percentages weighted for the numbers of fully and partially correct answers.

High and low performance in scientific literacy

Reference is made to some aspects of the distributions of scientific literacy results in Chapter 2. As cut-off scores defining proficiency levels were not set for the scientific literacy component of PISA, high and low achievers in this domain had to be identified in other ways. For example, the best five per cent of students internationally achieved 657 points on average across OECD countries, the best 10 per cent reached 627 points and the best 25 per cent, 572 points. The corresponding statistics for Australia were that the best five per cent achieved 675 points or more and the best 10 per cent and 25 per cent reached 646 points and 596 points, respectively. Sixty-two per cent of the Australian students scored more than 500, the OECD average. At the lower end of the scale, three-quarters of the students internationally achieved on average at least 431 points, 90 per cent reached 368 points and 95 per cent, 332 points. Corresponding results for Australia were that three-quarters of the students achieved at least 463 points, 90 per cent scored 402 or more and 95 per cent scored 368 or more. The composition of the high and low achieving groups in Australia is examined and discussed in Chapter 9.

Further consideration of results on mathematical literacy items

Analyses similar to those undertaken for the reading literacy items were carried out on the Australian responses to the mathematical literacy items. One item was deleted from the database after the main survey, leaving a total of 31 items to be analysed. The per cent correct in Australia on each item was compared first with the OECD average per cent correct and then with the highest per cent correct obtained by any country. The characteristics of 10 items the Australian students found easiest relative to the highest performing country on each item were compared with characteristics of the 10 items they found hardest in this respect. Gender differences in performance were examined for the items grouped in several ways. The analyses were undertaken to identify patterns, and hence the discussion is mostly descriptive. The number of mathematical literacy items per framework category is generally very small, except for the big ideas and the second competency class. Any comments made about patterns are therefore very tentative.

Australia compared with the OECD as a whole

Australian performance on all the mathematics items was above or similar to the OECD average. On 12 items the Australian and OECD results were 5 per cent or less apart, on 14 items they were between 5 and 10 per cent apart and on 5 items they were more than 10 per cent apart. All five of these items are Competency Class 2 items from the growth and change area. Three are classified as statistics, one as algebra and one as functions. Three are closed constructed response items, each requiring a short, unambiguous answer to be provided, and two are open constructed response items, requiring longer and more detailed answers. Apples Question 1, a closed constructed response item shown earlier in the chapter, is the only one of the five that has been released for public use.

The Australian students performed at or above the OECD average on all the mathematics items.

Three of the five algebra items and four of the eight geometry items in the test overall are in the group of 12 items on which Australia's performance was close to the OECD average. Nine of the 12 require short, unambiguous answers to be written in and three are multiple choice. In comparison with the distributions of items shown in Table 4.1, algebra, geometry and closed constructed response items are over-represented in the group on which Australia's performance was only average with respect to the OECD as a whole. Only two items from this group have been released. One is Apples Question 2 shown earlier in the chapter, the other is a geometry item, not included here, which requires knowledge of angles in a triangle.

Australia compared with the highest achieving country on each item

Australia achieved the highest result of any country on one item, a secure Class 2 statistics item classified as growth and change. Our students were within 5 percentage points of the highest achieving country on seven items altogether, six of these from growth and change. Three of these involve statistics, three involve functions and one is a geometry item. Extending the group to the ten items with the least difference between Australia's performance and the highest country's performance adds two more statistics and one more functions items, all from growth and change.

Australian performance on a statistics item relating to growth and change was highest of any country's.

Thus, five of the ten items on which Australia's performance was closest to that of the highest performing country per item are from the statistics strand, four are from the functions strand and one is from the geometry strand. All but one item, a space and shape item, are from the growth and change area. Five are multiple choice, three are closed constructed response and two are open constructed response items. Seven are categorised as Competency Class 2, two as Class 1 and one as Class 3. In terms of the total number of items, growth and change, statistics, functions, multiple choice and Competency Class 2 are all over-represented in this ten-item set.

Relative to the highest performing country in each case, the ten items done least well by the Australian students comprise one from each of statistics, functions and geometry, three from measurement and four from algebra. Six are from growth and change and four from space and shape. (The space and shape items are concentrated in the middle group). Seven are closed constructed response items and three are multiple choice, while six are Competency Class 2 and four are Class 1. In relation to the total number of items, algebra and closed constructed response items are clearly over-represented.

Taken together, these two sets of analyses show Australian students coping better with growth and change items, especially items involving functions and statistics, than with space and shape items. The Australian students also performed relatively better on multiple choice than on closed constructed response items (items requiring an unambiguous short answer to be provided). The data also suggest that our students have relatively more difficulty with algebra problems, and to some extent measurement problems, than with problems from other curricular strands.

Australian students performed relatively better on functions and statistics items than on algebra and measurement items.

Other analyses at item level

Some further analyses were undertaken on the Australian data to see if the lack of a significant gender difference in mathematical literacy was uniform for various categories of items. There was no difference in pattern between average per cents correct on growth and change items and on space and shape items by gender – males' results were three or four percentage points higher in each case, but not higher enough to be significantly different. The numbers of items within four ranges of difference in item facility (per cent correct) from the per cent correct in the highest performing country on each item[5] are shown separately by gender in Table 4.5. The data in the table show no clear difference in relative performance by gender, apart from a hint that males may have found growth and change items a little easier than females found them.

There was no clear gender difference in performance within Australia on any category of mathematics items in PISA.

There were two space and shape items and two growth and change items on which there was a difference of more than 10 in the percentages correct by gender. Males performed better than females on each of these. One was a 3-D geometry item that required visualisation of hidden features. Two were measurement items, one of which required judgements about relative lengths illustrated diagrammatically and the other, relating change in volume to a graphical representation. One, Racing Car Question 4 illustrated earlier in the chapter, was a functions item. The only aspect these items appear to have in common is that they depend on connections being made between information in a diagram and some other feature.

[5] The ranges show actual differences in per cent correct by gender, not one as a percentage of the other.

Table 4.5 Numbers of Mathematics Items in Given Ranges from the Highest Per Country Result, by Gender

Framework aspect	Total	Number of items per range from highest country result							
		Within 5%		Between 5 & 10%		Between 10 & 20%		More than 20%	
		Female	Male	Female	Male	Female	Male	Female	Male
Distributions of items from the mathematical big ideas									
Growth and change	18	5	8	3	3	7	6	3	1
Space and shape	13	1	1	4	5	5	7	3	0
Distributions of items from the mathematical curricular strands									
Algebra	5	0	0	0	1	3	3	2	1
Functions	5	2	4	1	0	1	1	1	0
Geometry	8	1	1	3	3	3	4	1	0
Measurement	6	0	0	1	3	3	3	2	0
Number	1	0	0	0	0	1	1	0	0
Statistics	6	3	4	2	1	1	1	0	0

>> *Further consideration of results on scientific literacy items*

Similar analyses to those carried out for reading and mathematical literacy items were also undertaken for the scientific literacy items. As with these analyses, the aim was to identify patterns, and hence the following discussion is descriptive only. The number of scientific literacy items per framework category is generally very small. Any comments made about patterns are therefore very tentative.

Australia compared with the OECD as a whole

Australian performance on all but one of the science items was above or similar to the OECD average. On 16 items the Australian and OECD results were 5 percentage points or less apart, on 13 items they were between 5 and 10 percentage points apart and on four items they were more than 10 percentage points apart. Three of these last four are physics/chemistry items and one is a biology item. In terms of science major areas, two are classified as science in technology, one as science in life and health and one as science in Earth and environment.[6] Two involve the process of identifying evidence or data needed in an investigation, one involves recognising a question that can be investigated scientifically and one involves drawing or evaluating a conclusion. Two are open constructed response items and two are complex multiple choice items. The one item on which Australia's performance was more than 5 percentage points below the OECD average is a multiple choice Earth/space item in the major area of science in Earth and environment, and which involves demonstrating understanding of a scientific concept. None of the five items referred to in the latter part of this paragraph has been released.

Australian performance was at or above the OECD average on all but one science item ….

[6] Most of the discussion in this section is in terms of the items considered in their subject matter areas, given that these are likely to be more meaningful to teachers.

The 16 items on which Australia's performance was approximately at the OECD average include seven in physics/chemistry, six in biology and three in Earth/space. All the science areas of application are represented in this set. Seven of the items are multiple choice, seven are open constructed response and two are complex multiple choice items. Ten involve demonstrating conceptual understanding, and two each involve recognising questions, drawing and evaluating conclusions, and communicating conclusions to others. Three of the four Semmelweis items shown earlier in the chapter are in this item group (all except Question 3, on which Australia performed relatively better). Both demonstrating understanding and open constructed response items are over-represented in this group.

Australia compared with the highest achieving country on each item

Australia achieved the highest result of any country on one item, a secure item requiring identification of evidence needed in an investigation. Including this item, our students were within 5 percentage points of the highest achieving country on ten items – five in physics/chemistry, three in biology and two in Earth/space. All ten items relate to the processes connected with understanding the nature of science, not to demonstrating conceptual understanding. All item types are represented, as are all science major areas. Four items focus on the structure of matter, three on atmospheric/physical change, two on ecosystems and one on genetic control. The first and fourth Ozone examples presented in this chapter are in this set of items.

…. including achieving the highest results of any country on an item about evidence needed in a scientific investigation.

Considering the three items on which the Australian students performed least well relative to the highest performing country in each instance, two are physics/chemistry items about energy transfer and one is an Earth/space item. All involve demonstrating understanding of scientific concepts and all are secure items. Extending this to the ten items on which our students' result was furthest from the highest performing country's result, five are in physics/chemistry, three are in Earth/space and two are in biology. Three are concerned with energy transfer, three with atmospheric or geological change, two with Earth and environment and one with form and function. Five involve demonstrating understanding, three involve drawing or evaluating conclusions, one involves communicating a conclusion and one involves recognising a question that can be investigated scientifically. Six are open constructed response items, while the other four are spread among three other item types.

Taken together, the analyses in this and the preceding section suggest that Australian students perform better on processes related to the nature of scientific investigations than they do on items requiring understanding of scientific concepts. They also appear to have relatively more difficulty with open constructed response items when compared with the highest achieving country per item.

Other analyses at item level

Some further analyses were undertaken on the Australian data to see if the lack of a significant gender difference in scientific literacy was uniform for various categories of items. There was an expected difference in pattern between average per cents correct per subject matter area – males' results were about 3 percentage points higher than females' results in physics/chemistry and females' results were better than males' by about the same amount in biology. These apparent differences were not large enough to be significant, however. Likewise, there was no gender difference in average percentages correct for the science major areas. Results on the nature of scientific investigations items as a set and on the demonstrating understanding items as a set were then considered. Females' average performance was about 4 percentage points higher than males' on nature of scientific investigations and lower than males' by the same amount on demonstrating understanding. It appears that, compared with males, females' level of conceptual understanding in science may be less developed and their level of understanding of scientific procedures may be more developed.

Females in Australia showed a better understanding of science processes than males did, but the reverse was found for understanding of science concepts.

The numbers of items within four ranges of difference in item facility (per cent correct) from the per cent correct in the highest performing country on each item are shown separately by gender in Table 4.6. The data in the table support the relative performance of males and females with respect to conceptual understanding and to scientific procedures as identified in the previous paragraph. There is also a suggestion that females experience more difficulty than males with items on energy transfer.

Table 4.6 Numbers of Science Items in Given Ranges from the Highest Per Country Result, by Gender

		Number of items per range from highest country result							
		Within 5%		Between 5 & 10%		Between 10 & 20%		More than 20%	
Framework aspect	Total	Female	Male	Female	Male	Female	Male	Female	Male
Distributions of items by science process									
Communicating	3	1	1	0	0	2	2	0	0
Drawing conclusions	6	2	1	0	2	3	2	1	1
Identifying evidence or data	5	2	1	3	3	0	1	0	0
Recognising questions	5	3	1	1	2	1	2	0	0
Demonstrating understanding	15	1	3	3	4	7	5	4	3
Distributions of items by science area of application									
Atmos./chem./ phys./geol. chnge	7	3	2	0	1	3	4	1	0
Biodiversity and ecosystems	4	2	0	0	3	2	1	0	0
Earth and universe	5	0	0	1	2	3	2	1	1
Energy transfer	3	0	0	0	1	0	1	3	1
Form and function	3	0	0	2	2	1	1	0	0
Genetic control	2	1	1	0	1	1	0	0	0
Human biology, physiol. change	4	0	0	2	0	2	2	0	2
Structure of matter	6	3	4	2	1	1	1	0	0

There were six items where the gender difference in per cent correct was greater than 10. On two of these, one in human biology and one in structure of matter, females outperformed males. The four on which males outperformed females comprised one in each of ecosystems and genetic control and two in energy transfer.

>> *Summary*

The PISA mathematical and scientific literacy results are enriched in several ways in this chapter, which reports the outcomes of a range of analyses. Descriptions of the tasks at high, medium and low positions on the PISA scales are provided, which indicate the kinds of skills that students at corresponding levels of proficiency are typically able to demonstrate. Sample mathematics and science items are included to illustrate the range of difficulty of PISA tasks, the kinds of items used and the framework aspects assessed. An example of the instructions for marking open-ended items is also included.

Australian students performed relatively well in mathematical and scientific literacy, as shown also in Chapter 2. In mathematical literacy, the highest performing five per cent of Australian students achieved 679 points or more on the PISA scale, compared with 655 points or more for the OECD countries combined. The best 10 and 25 per cent in Australia reached 647 and 594 points, respectively, compared with 625 and 571 points for the OECD as a whole. In scientific literacy, the highest performing five per cent of Australian students achieved at least 675 points on the PISA scale, compared with 657 points or more for the OECD countries combined. The best 10 and 25 per cent in Australia achieved at least 646 and 596 points, respectively, compared with 627 and 572 points for these groups in the OECD as a whole.

Analyses of results at item level were carried out in an attempt to identify areas of strength and weakness in Australian students' mathematical and scientific literacy skills. The data suggested some possibilities in this respect, but the possibilities have to be viewed as very tentative because of the small numbers of items in the mathematical and scientific literacy components of the PISA 2000 assessment.

In mathematics, the Australian students seem to have coped better with items from the major area of growth and change, compared with items from the area of space and shape. The students' performance on statistics and functions items was better than their performance on measurement and algebra items. They were also relatively more successful on multiple choice items than on items requiring constructed responses. No clear difference in relative performance of males and females was found for any of the framework aspects. Australian performance was at or above the OECD average performance on all the mathematics items and was highest of any country on one statistics item.

In science, there is a suggestion that the Australian students fared better on items assessing understanding of scientific investigations than understanding of concepts. There was no gender difference in performance according to science major area (Earth and environment, life and health, and technology) but females outperformed males in their understanding of scientific investigations and the reverse occurred for understanding of concepts. There were two items on which there was a large gender difference in performance in favour of males, both on the topic of energy transfer. Australian performance was at or above the OECD average performance on all but one of the science items and was highest of any country on one science process item requiring identification of evidence needed in an investigation.

Chapter **FIVE**

RESULTS WITHIN AUSTRALIA

In Chapter 2, the national achievement results for Australia are presented in relation to the results for the OECD as a whole and for each country separately. This chapter presents results for the Australian states and territories and for minority groups such as Indigenous students and students with a language background other than English. Gender breakdowns of results for Australia as a whole are included in Chapter 2, but are included in this chapter for the states and territories.

Oversampling of schools was done in all but New South Wales, Victoria and Queensland, to enable reliable estimates of achievement to be made in all states and territories. School sector was used as a stratification variable for sampling purposes, but is not used as a reporting variable.

>> *Comparing the Australian states and territories*

There are always difficulties in comparing aspects of education in the Australian states and territories. Many education policies are set at state level[1] and there are both structural and curriculum differences in school systems from state to state. Differences in school starting age typically lead to difficulties in the interpretation of results from comparative studies. If grade-based samples are used, we have different age distributions of sampled students by state and if an age cohort is used the students are to some extent in different grades. The approach taken in PISA, of choosing to sample 15-year-olds because they are in their last year of compulsory schooling in most OECD countries, has a logical basis for comparability, even though the students are in different grades from country to country. Differences internationally are larger than they are between the Australian states – Brazil, which has 15-year-olds enrolled as far back as second grade, is the extreme case.

[1] States and territories are referred to collectively as 'states' for the remainder of the chapter.

Year levels of the sampled Australian students

The expected distribution of 15-year-olds by year level, based on Australian Bureau of Statistics data, is tabulated in Appendix 2. The actual distribution of respondents is shown by state in the next chapter, in Table 6.2. Nationally, three quarters of the Australian PISA participants were in Year 10, 17 per cent in Year 11 and 7 per cent in Year 9. From Table 6.2 it can be seen that Western Australia and Queensland had almost half and more than 40 per cent, respectively, of their sampled students in Year 11. This was fully as expected, given their different starting age policy combined with the fact that the PISA students would have gone straight into Year 1 when they started school in these states. The other states are more uniform in the distribution of students by year level, though both South Australia and the Northern Territory have proportionally more Year 11 students than the remaining states. The school starting ages at the time when the PISA students were beginning their formal schooling, and the best estimate of the percentages of five-year-olds enrolled, are shown by state in Table 5.1. The main conclusion from this table is that the majority of students aged 15 in Queensland and Western Australia may have had up to a year less time in formal schooling than students in other states. The influence on outcomes of this difference in length of schooling is not known, but is expected to be relatively small for 15-year-olds – much smaller than it might be at primary level, for example.

Most of the Australian students in PISA were in Year 10, though there were some differences by state because of different school starting ages.

Table 5.1 School Starting Age Policy Differences in Australian Education Systems

State/territory	Expected age range on entry to full-time school in late 1980s	First year of full-time school	Children aged 5 or under in full-time schooling in 1989-90, as a percentage of the estimated cohort size
New South Wales	4y 6m to 5y 5m	Kindergarten	96
Victoria	4y 7m to 5y 6m	Preparatory	82
Queensland	5y 1m to 6y 0m	Year 1	44
South Australia	5y 0m (continuous enrolment)	Reception*	95
Western Australia	5y 1m to 6y 0m	Year 1	47
Tasmania	5y 7m to 5y 11m	Prep./Year 1#	60
Northern Territory	5y 0m (continuous enrolment)	Transition*	89
Australian Capital Territory	5y 0m (continuous enrolment)	Kindergarten	96

* Children can spend less or more than a year in these programs, depending on when they enrol and how well they progress.
\# Until 1994, children older than 5 years 6 months on entry to school were enrolled in Year 1.

Means and distributions of achievement by state

Mean performance in each of reading, mathematical and scientific literacy is illustrated by state in Figures 5.1 to 5.3, respectively, using the same format as the international charts in Chapter 2. To place the Australian state results in perspective, the means and distributions for the highest-achieving country and for the OECD as a whole are included in the figures.

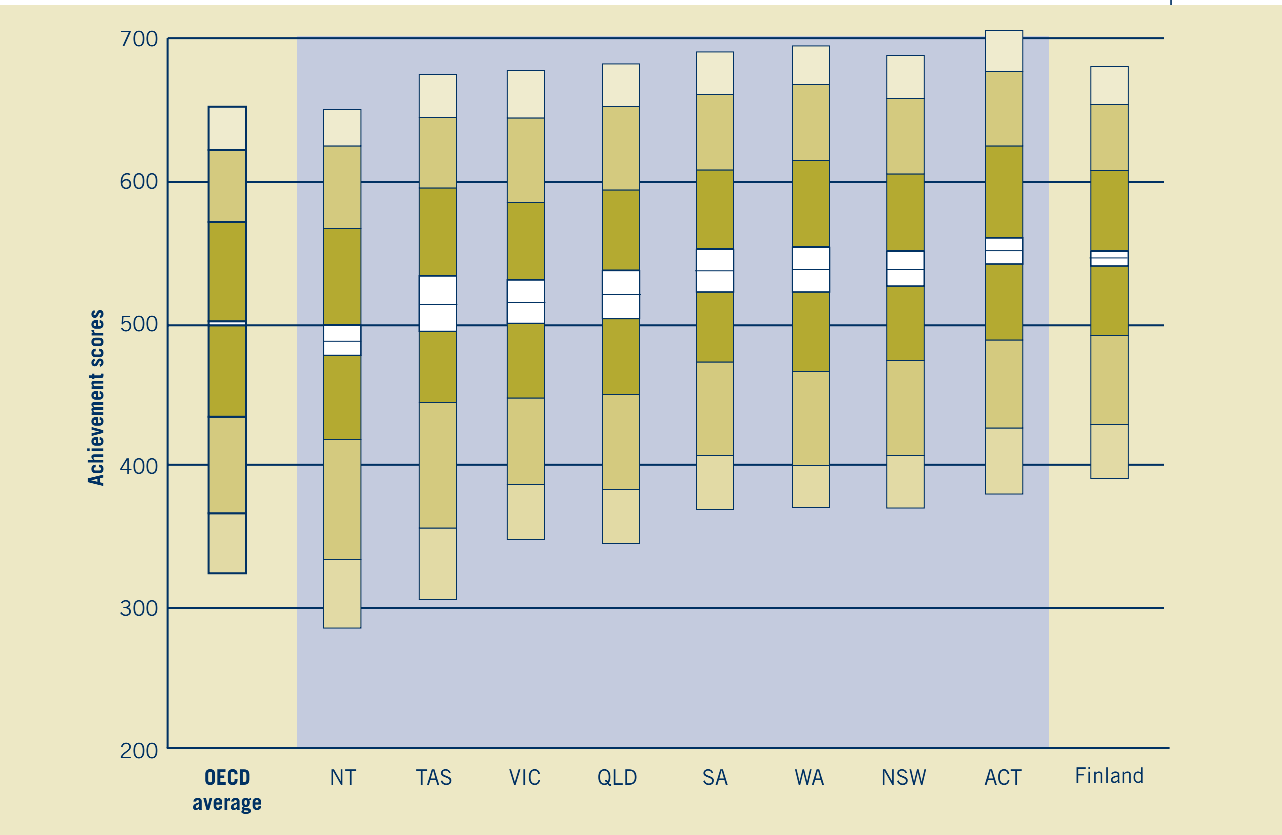


Figure 5.1 Student Achievement by State and Territory on the Combined Reading Literacy Scale

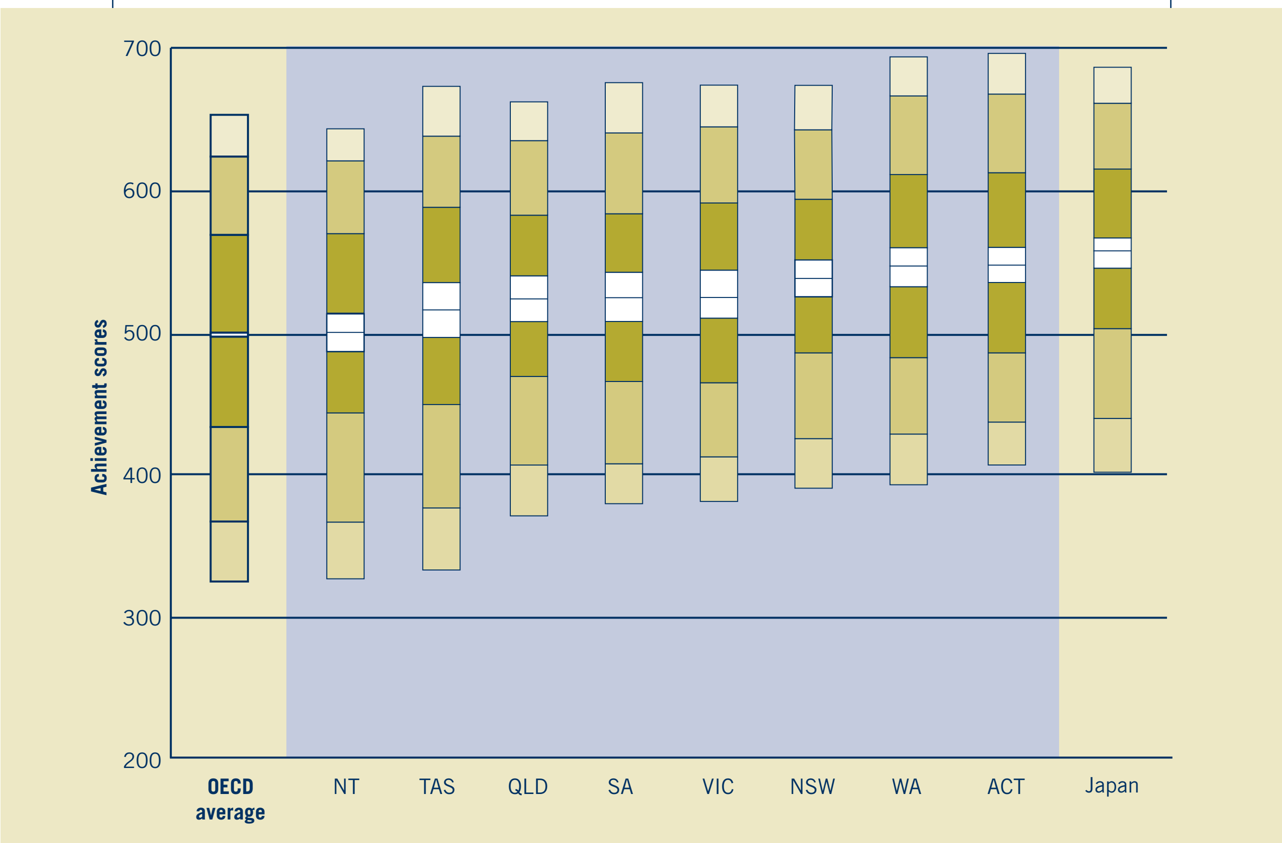


Figure 5.2 Student Achievement by State and Territory on the Mathematical Literacy Scale

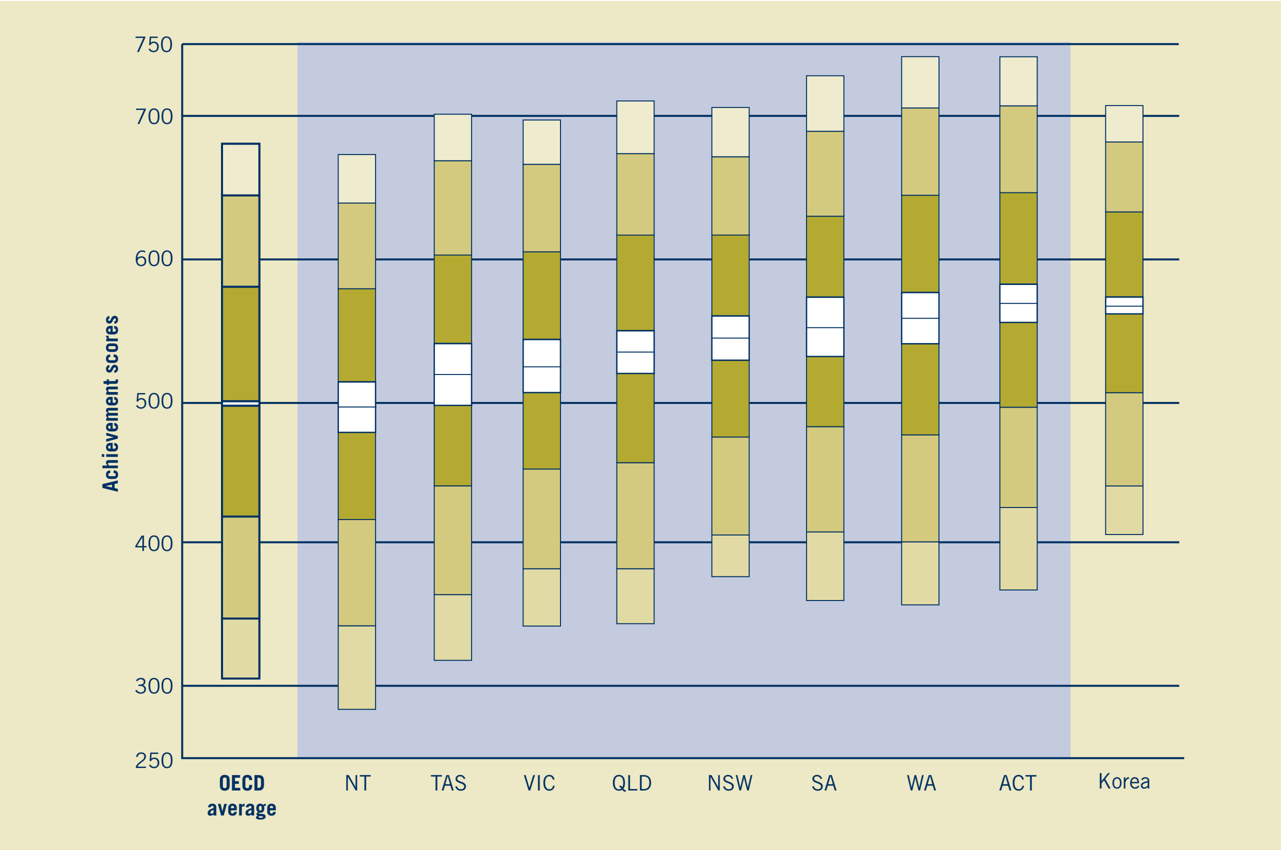


Figure 5.3 Student Achievement by State and Territory on the Scientific Literacy Scale

There are several interesting features of these charts. The confidence interval,[2] shown by the white box in the middle of each bar, is either higher than or overlaps the OECD average in all instances. Thus, even in the lower-achieving states, our students performed on average at least as well as the students on average across the OECD. Further, in both reading and mathematics, students from the Australian Capital Territory, New South Wales and Western Australia performed on a par with the highest-achieving country. Students from South Australia also performed at this level in reading. In science, students performing on a par with the highest-achieving country were those from the Australian Capital Territory, Western Australia and South Australia. The 95th percentile for several states was at least equivalent to the 95th percentile of the highest-achieving country in each assessment domain.

Students in several Australian states performed on a par with students in the highest-achieving country in each domain.

The other feature of the charts is the greater number of similarities than differences apparent in the Australian states' results. Significant differences in achievement by state are examined in the next section. Underlying the state comparisons is an issue associated with the proportions of male and female respondents within the various states, given the extent of gender differences in reading achievement identified in Chapter 2. This issue is discussed later in the chapter, in the section on gender differences by state.

[2] See the Glossary for an explanation of this term.

Multiple comparisons of achievement

The means and standard error terms in each assessment domain are shown by state in the following three tables. The same statistical technique as used in Chapter 2 for comparing the country results was followed in preparing these tables. It is also the same technique as was used in TIMSS and in the repeat of TIMSS. The technique provides for comparing results of several groups simultaneously in what are usually referred to as 'multiple comparisons'. Tests of significance were adjusted for the number of simultaneous comparisons being made, so that the probability level remained at .05. Various statistical terms used in this and the following paragraphs are explained in the Glossary.

Reading literacy

Results of the multiple comparison tests of significance of the differences in reading literacy mean scores between states are presented in Table 5.2. These show that most of the states achieved results equivalent to each other's when the results were analysed simultaneously. The Australian Capital Territory students achieved a mean that was significantly higher than the means of Queensland, Victoria, Tasmania and the Northern Territory, while students from New South Wales, Western Australia, South Australia, Queensland and Victoria all performed significantly better than students in the Northern Territory. If a state were interested in comparing itself with one or two other states only, then a few more of the differences would be statistically significant (because the multiple comparisons build in a factor to allow for the number of comparisons being simultaneously made). For example, New South Wales's result in reading literacy is not different from the results in Western Australia, South Australia and Queensland, but is significantly higher than Tasmania's as well as the Northern Territory's.

Table 5.2 Multiple Comparisons of Total Reading Literacy Results, by State

			ACT	NSW	WA	SA	QLD	VIC	TAS	NT
		Mean	552.2	538.8	537.9	537.0	521.0	515.9	514.1	488.6
	Mean	SE	4.6	6.3	8.0	7.7	8.6	7.6	9.7	5.6
ACT	552.2	4.6		0	0	0	1	1	1	1
NSW	538.8	6.3	0		0	0	0	0	0	1
WA	537.9	8.0	0	0		0	0	0	0	1
SA	537.0	7.7	0	0	0		0	0	0	1
QLD	521.0	8.6	-1	0	0	0		0	0	1
VIC	515.9	7.6	-1	0	0	0	0		0	1
TAS	514.1	9.7	-1	0	0	0	0	0		0
NT	488.6	5.6	-1	-1	-1	-1	-1	-1	0	

*Note: Read **across** the row to compare a state's performance with the performance of each state listed in the column headings.*

1 Average performance statistically significantly higher than in comparison state
0 No statistically significant difference from comparison state
-1 Average performance statistically significantly lower than in comparison state

The multiple comparison charts for the reading process sub-scale means are not shown, as they were identical to the chart for reading literacy overall in the picture of significant differences portrayed.

Mathematical literacy

Table 5.3 presents the outcomes of multiple comparison tests of the mathematical literacy results by state. Even fewer of the comparisons were statistically significant than for reading. The chart shows an almost uniform picture of performance, except that students from the Australian Capital Territory outperformed students from Tasmania and the Northern Territory, and students from Western Australia and New South Wales outperformed their counterparts from the Northern Territory. In this instance, comparisons of states in pairs would not produce further significant differences because of the equivalence of the results from the Australian Capital Territory to Queensland on the chart.

Table 5.3 Multiple Comparisons of Mathematical Literacy Results, by State

			ACT	WA	NSW	VIC	SA	QLD	TAS	NT
		Mean	548.3	546.9	539.7	528.9	526.3	525.0	517.3	501.7
	Mean	SE	6.2	6.8	6.5	8.1	8.6	7.7	9.7	6.7
ACT	548.3	6.2		0	0	0	0	0	1	1
WA	546.9	6.8	0		0	0	0	0	0	1
NSW	539.7	6.5	0	0		0	0	0	0	1
VIC	528.9	8.1	0	0	0		0	0	0	0
SA	526.3	8.6	0	0	0	0		0	0	0
QLD	525.0	7.7	0	0	0	0	0		0	0
TAS	517.3	9.7	-1	0	0	0	0	0		0
NT	501.7	6.7	-1	-1	-1	0	0	0	0	

Note: Read ***across*** *the row to compare a state's performance with the performance of each state listed in the column headings.*

1 Average performance statistically significantly higher than in comparison state
0 No statistically significant difference from comparison state
-1 Average performance statistically significantly lower than in comparison state

Scientific literacy

There was less uniformity between the states in scientific literacy results than for reading or mathematical literacy. The multiple comparisons of means are shown in Table 5.4.

The table shows that the Australian Capital Territory's students performed significantly better than Queensland's, Victoria's, Tasmania's and the Northern Territory's students in scientific literacy; Western Australian students performed significantly better than students from Tasmania and the Northern

Territory; and students from South Australia, New South Wales and Queensland each significantly outperformed students from the Northern Territory. Victoria's and Tasmania's results were not significantly different from the Northern Territory's.

Table 5.4 Multiple Comparisons of Scientific Literacy Results, by State

			ACT	WA	SA	NSW	QLD	VIC	TAS	NT
		Mean	553.0	543.9	538.9	531.8	523.2	515.5	509.9	489.6
	Mean	SE	5.9	7.7	9.2	6.9	6.7	8.1	9.3	7.6
ACT	553.0	5.9		0	0	0	1	1	1	1
WA	543.9	7.7	0		0	0	0	0	1	1
SA	538.9	9.2	0	0		0	0	0	0	1
NSW	531.8	6.9	0	0	0		0	0	0	1
QLD	523.2	6.7	-1	0	0	0		0	0	1
VIC	515.5	8.1	-1	0	0	0	0		0	0
TAS	509.9	9.3	-1	-1	0	0	0	0		0
NT	489.6	7.6	-1	-1	-1	-1	-1	0	0	

*Note: Read **across** the row to compare a state's performance with the performance of each state listed in the column headings.*

1 Average performance statistically significantly higher than in comparison state
0 No statistically significant difference from comparison state
-1 Average performance statistically significantly lower than in comparison state

The states were also mostly similar to each other in their distributions of scores. This can be seen from the charts in Figures 5.1 to 5.3. The charts show that the Northern Territory had a larger spread of scores than the other states in reading and science, while Tasmania had a larger spread in mathematics.

In general

The comparative results between the states presented in this chapter have not yet made any allowance for contextual variables, such as socioeconomic area of the schools and other important background characteristics of the students. Analyses in which these variables are taken into account are presented and discussed in Chapters 7 and 8.

Distributions of proficiency levels

Given the extent of uniformity in the achievement means and distributions by state, the distributions of proficiency levels within the various states would also be expected to be similar. The distributions are shown for the total reading literacy scale in Figure 5.4. Apart from the very high percentages of students at Level 5 in the Australian Capital Territory and Western Australia and the comparatively high

There were few differences by state in distributions of reading proficiency levels, though Tasmania and the NT had proportionally more low achievers and the ACT and WA had proportionally more high achievers.

percentages at no more than Level 1 in Tasmania and the Northern Territory, the percentages at other levels are reasonably uniform. The proficiency level distributions for the OECD as a whole and for Finland, the highest-achieving country in reading, are also included in the figure for ease of comparison.

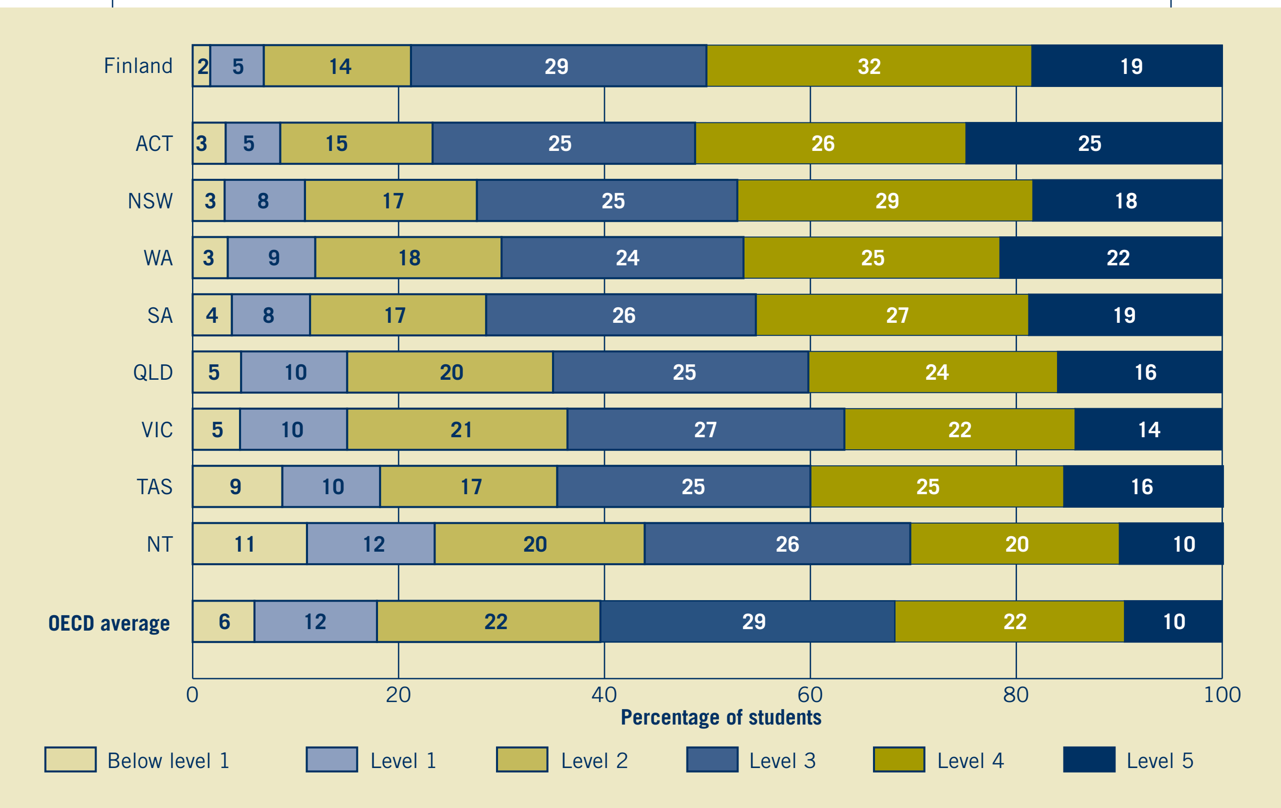


Figure 5.4 Proficiency Levels by State and Territory on the Combined Reading Literacy Scale

From the figure, it can be seen that the percentages of students at PISA's highest level of proficiency from the Australian Capital Territory, Western Australia, South Australia and New South Wales are equal to or higher than the percentage in Finland. Further, the proficiency distribution in the Northern Territory is similar to the distribution for the OECD as a whole except at the lowest levels.

A further perspective on proficiency levels is provided in Table 5.5, where the percentages of students proficient at no more than Level 1 and the percentages proficient at Level 4 or Level 5 are shown. Taking both Levels 4 and 5 into account, the ACT is on a par with Finland, and New South Wales, Western Australia and South Australia are not far behind. While Tasmania has a relatively high percentage of students at Level 1 or below, it also has more than 40 per cent of its students at Level 4 or Level 5, almost ten points above the percentage for the OECD as a whole.

Table 5.5 Percentages by State at Low and High Reading Proficiency Levels

State/Terr.	No more than Level 1	At Level 4 or Level 5
NSW	11	47
VIC	15	36
QLD	15	40
SA	12	46
WA	12	47
TAS	19	41
NT	23	30
ACT	8	51
OECD	18	32

Once again, it needs to be remembered that no account has been taken in these analyses of school intake or other relevant contextual variables.

Gender differences by state

The reading, mathematical and scientific literacy results were examined for gender differences within each state, to see if the differences in reading literacy and lack of differences in the other two domains were uniform across the country. None of the means in mathematics or science was significantly different by gender in any state. The actual best estimates were close to identical for males and females in science, except in each of Queensland and Tasmania, where the females' estimate was higher by about 17 scale points, but this difference was not large enough to be statistically significant at the .05 level.

In mathematics, the means by gender were close to identical in the Northern Territory, Queensland, Tasmania and Western Australia. In the other states the best estimates for males were 15 to 20 scale points higher than for females, though again the differences were not large enough to be statistically significant at the .05 level. Given the relatively short mathematical and scientific literacy tests in PISA 2000, the standard error terms were quite large in relation to the means, which makes it more difficult to establish significant differences if such really exist. It will be interesting to see if, with the longer tests in PISA 2003 for mathematics and in PISA 2006 for science, the standard errors will be smaller and might allow more sensitive significance tests to be carried out.

The comparison of reading results by gender within states is a different matter. The overall gender difference in reading was quite large, as discussed in Chapter 2, and was found in the analyses done for this chapter to carry through to the results by state, as presented in Table 5.6. Females outperformed males everywhere but in the Australian Capital Territory, where the lack of a significant difference may be more an artefact of the larger standard errors than of a similarity in performance (though the difference between the best estimates of performance is smaller in the ACT than elsewhere).

The gender differences in reading literacy found internationally also permeated the Australian states.

Table 5.6 Reading Literacy Results by Gender Within State

State/Terr.	% female in sample	Females		Males		Difference	p <
		Mean	SE	Mean	SE		
NSW	49	554.7	6.9	525.0	8.9	29.7	.01
VIC	42	532.0	13.3	504.2	6.7	27.8	.05
QLD	50	545.0	11.6	498.4	8.6	46.6	.01
SA	53	550.6	9.3	521.8	10.7	28.8	.05
WA	45	557.0	9.5	522.7	9.6	34.3	.01
TAS	48	540.8	9.1	491.1	12.1	49.7	.001
NT	50	505.3	7.1	474.8	9.0	30.5	.01
ACT	51	564.7	10.1	541.9	14.0	22.8	ns

The table provides information on the percentage of the sample in each state who were female. The percentage of females in the total Australian sample was 47.4. Percentages in the range 47 to 53 can be attributed to sampling error. The table shows that the percentage of females in both Western Australia and Victoria are below 47, and to a large enough extent in Victoria that Victoria's results in reading are very likely to be underestimates of that state's performance. The gender imbalances are not an issue in relation to mathematics and science results, given that males and females performed at equivalent levels in these domains.

The gender differences in reading performance found by state across Australia in PISA reinforce the need for the prevailing concern about the educational progress of boys, as reading literacy skills are necessary in all spheres of life in industrialised societies. Based on the PISA results, the need for concern appears to be greatest in Queensland and Tasmania, where the gender differences in reading skills were close to half a standard deviation in magnitude.

The greatest gender differences in reading skills in Australia occurred in Queensland and Tasmania, where females outscored males on average by almost 50 scale points.

>> *Results for Indigenous students*

One hundred and ninety-two students identified themselves as of Indigenous origin in the PISA main sample. An additional 300 Indigenous 15-year-old students from the sampled PISA schools also participated in the assessment, as a special national option. The weighted percentage of Indigenous students in the total PISA sample was 2.4. The Indigenous students' PISA results are shown in Table 5.7, together with the non-Indigenous students' results.

All differences were statistically significant at a very high level of confidence and are clearly also significant in educational terms. There are clearly large performance differences in reading, mathematical and scientific literacy skills between the Indigenous and non-Indigenous students on average. Nevertheless, there were Indigenous students who were placed at the highest proficiency level on each reading component, as shown in Table 5.8. The table presents the distributions of Indigenous and non-Indigenous students at the various reading proficiency levels. Information on the Indigenous students who performed at particularly high and low levels is included in Chapter 9. Further analyses of the Indigenous students' data will be published as a separate report.

In Australia, Indigenous students achieved lower scores than non-Indigenous students in all domains.

Table 5.7 Means and Standard Deviations for Indigenous and Non-Indigenous Students

Student group	Reading total	Reading: retrieving	Reading: interpreting	Reading: reflecting	Mathematical literacy	Scientific literacy
Indigenous	448.1 (102.0)	451.2 (110.5)	446.0 (101.6)	449.7 (103.5)	449.4 (89.4)	447.8 (97.9)
Non-Indigenous	530.8 (100.0)	537.4 (106.7)	528.8 (103.2)	527.7 (100.2)	535.1 (88.1)	529.3 (94.4)
TOTAL	528 (102)	536 (108)	527 (104)	526 (100)	533 (90)	528 (94)

Table 5.8 Distributions (%) of Reading Proficiency Levels for Indigenous and Non-Indigenous Students

Student group	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Total
Indigenous	11	24	25	25	7	8	100
Non-Indigenous	3	9	19	26	26	19	100
TOTAL	3	9	19	26	25	18	100

>> *Results for students from a language background other than English*

Students whose main language at home was not English were not oversampled in PISA. As part of the main sample, almost 900 students said that they were in this category (about 17 per cent of the sample). Their results on the PISA tests are shown in Table 5.9, together with the English language background students' results. In all cases, except for mathematical literacy, the differences in means between the English and non-English groups were statistically significant. The largest difference in best estimates of performance for these groups was in scientific literacy, the smallest in mathematical literacy.

Students whose home language was not English performed at an equivalent level in mathematics to students whose home language was English, but at a lower level in reading and science.

Both the mathematics and science items were presented in contexts that required students to read passages of text (see examples in the previous chapter). Thus the mathematical and scientific literacy components of PISA were measures of reading skills as well as of mathematics and science skills, though the reading load of the mathematics items was less than that of the science items. This mixing of what was being assessed was a consequence of the aim that all items would be contextualised. Reviewers of the assessment frameworks in Australia supported this aim, but it seems that, in future PISA cycles, more effort should be invested in reducing the verbal complexity of texts in the science component.

Table 5.9 Means and Standard Deviations for Students by Main Language Spoken at Home

Student group	Reading literacy	Reading: retrieving	Reading: interpreting	Reading: reflecting	Mathematical literacy	Scientific literacy
Home language not English	505.8 (101.2)	511.3 (108.1)	500.7 (103.3)	507.5 (100.6)	521.6 (90.0)	496.5 (96.7)
Home language English	534.8 (99.1)	541.8 (105.6)	533.4 (102.4)	530.7 (99.7)	537.0 (88.0)	534.3 (93.0)
TOTAL	528 (102)	536 (108)	527 (104)	526 (100)	533 (90)	528 (94)

The distributions of reading proficiency levels for these two groups are shown in Table 5.10. Considering the data in Tables 5.8 and 5.10, the language background groups were much more similar to each other in reading proficiency levels than the groups based on Indigenous status were.

Table 5.10 Distributions (%) of Reading Proficiency Levels by Main Language Spoken at Home

Student group	Below Level 1	Level 1	Level 2	Level 3	Level 4	Level 5	Total
Home language not English	6	12	23	26	20	13	100
Home language English	3	8	18	25	27	19	100
TOTAL	3	9	19	26	25	18	100

Further analyses of the Australian achievement data for a range of aspects of ethnicity will be published as a separate report.

Internationally, eight countries did not include the question on language spoken at home in their Student Questionnaire. In all countries that used the question, reading literacy achievement was significantly higher for students who spoke the language of the test at home most of the time than for students who spoke another language at home. The same pattern as was found in Australia was echoed in all but a handful of countries – there was typically a significant difference in scientific literacy achievement for these groups of students but not in mathematical literacy achievement.

>> *Results based on location of school*

Data were collected from principals about the kind of community in which their school is situated. The School Questionnaire responses on that question are summarised in the next chapter. In addition to that information, data for the PISA schools were also obtained from the Australian Bureau of Statistics, which provided code values from two very recently developed classifications. One classification indicates five categories of relative remoteness in terms of both distance and access to services and facilities, known as ARIA Plus (ABS, 2001) and the other, which is closely related but not identical, is known as the 'Jones Classification'.[2] It is not known at this time which of these classifications might become more widely used in the future, and hence the PISA reading results, as well as a few other variables, were analysed in relation to each of them. The results are presented in Table 5.11 for ARIA Plus and in Table 5.12 for the Jones classification.

The tables indicate that there is close correspondence between the first two Jones categories and the first ARIA category, covering major urban areas. ARIA provides for remote areas to be broken into two groups, remote and very remote, which together are the same in the PISA data as Jones' remote zone. The substantial difference between the two classification systems is in the categories of inner and outer regions in ARIA compared with provincial cities and other regional areas in Jones' system. There were 0.6 per cent of PISA students attending schools in remote areas and 0.3 per cent in very remote areas. These two groups have been combined in the table because of the very small numbers of students.

[2] This classification was developed by Roger Jones in 2001 for the National Education Performance Monitoring Taskforce

Table 5.11 Distributions of Schools and Students, and Mean Achievement Results*, by ARIA Plus Category

ARIA Plus Category	Percentage of schools	Percentage of students	Reading literacy	Mathematical literacy	Scientific literacy
Major Cities of Australia	59.3	63.6	541.3 (4.8)	537.9 (4.4)	531.6 (4.8)
Inner Regional Australia	23.0	27.0	533.7 (5.4)	531.2 (6.7)	527.0 (5.8)
Outer Regional Australia	13.4	8.5	509.7 (4.4)	507.6 (6.3)	500.1 (4.5)
Remote/Very Remote Australia	4.3	0.9	494.8 (8.8)	513.9 (11.8)	481.2 (10.4)
TOTAL	100.0	100.0	528 (3.5)	533 (3.5)	528 (3.5)

* Standard errors of the means are shown in parentheses.

Table 5.12 Distributions of Schools and Students, and Mean Achievement Results*, by Jones Classification Category

Jones Category	Percentage of schools	Percentage of students	Reading literacy	Mathematical literacy	Scientific literacy
Mainland State Capital City Regions	47.2	58.2	540.2 (5.0)	537.7 (4.7)	531.0 (5.0)
Major Urban Statistical Districts	19.0	9.8	545.8 (8.5)	531.9 (8.2)	530.2 (9.5)
Provincial City Statistical Districts	15.2	14.1	534.8 (6.5)	533.0 (9.8)	526.0 (7.9)
Other Regional Areas	14.3	17.0	520.4 (4.5)	520.3 (5.4)	516.2 (5.4)
Remote Zone	4.3	0.9	494.8 (8.8)	513.9 (11.8)	481.2 (10.4)
TOTAL	100.0	100.0	528 (3.5)	533 (3.5)	528 (3.5)

* Standard errors of the means are shown in parentheses.

Multiple comparisons of achievement differences between groups of students assigned to the categories of each classification system were carried out. In relation to ARIA, students in major cities and inner regional areas outperformed students in outer regional and remote areas in reading and science, while students in major cities and inner regional areas outperformed students in outer regional areas. Using the Jones system, there was no difference in performance between the five categories in mathematics, but students in all the other regions achieved significantly higher reading and science results than students in the remote zone. Students in mainland capital cities and other major urban districts also outperformed students in Jones' 'other regional areas' category in reading.

Students attending schools in remote areas of Australia tended to perform less well than students in other areas ….

Both systems allow us to see that there was little difference in performance between students from schools located in major cities and other urban districts, and also that students whose schools are located in provincial cities also achieved on a par with their urban counterparts. The latter shows more prominently in the Jones system, as the

…. while students in provincial cities performed at the same level as students in major urban areas.

ARIA system has some additional towns together with the city-sized towns in its 'outer regional' category. The relatively lower achievement of students in remote schools, except in mathematics, is apparent from both systems.

Issues of remoteness will be explored further in a focused report to be published in 2002. As a preliminary step for that, the average socioeconomic status (SES), as measured by the higher status occupation of mother or father, was computed and tested in multiple comparisons for significance of differences by category. The results of these comparisons generally bore out expectations. Students from major cities and other urban areas had higher SES backgrounds than students from all other areas. Using the Jones system, students from provincial cities were significantly higher in SES than students from other regional areas, and, using the ARIA system, students from inner regional areas had higher SES backgrounds than students in outer regional and remote areas. The differences in SES by region are no doubt part of the explanation of the differences in achievement reported in this section.

Results by state on other variables

It is beyond the scope of this report to carry out in-depth analyses of state results except for achievement – such analyses will be carried out and reported separately from this first report. However, four variables of particular interest were examined to provide a preliminary picture – school disciplinary climate; students' feeling that school is a place where they belong; the extent of students' engagement in reading; and students' perceived comfort and ability in using computers. The way these scales were defined can be seen in Appendix 4.

Students' feelings of 'belonging' to their schools were essentially uniform across the country, except in Tasmania where proportionally more students had lower scores on this scale. Students in Western Australia reported the highest level of positive disciplinary climate in their schools than students in most other states did. Students in the Northern Territory and Victoria registered the lowest levels on this variable. Australia had one of the highest average scores internationally on the computer comfort index, and the high scores were found to apply across all states. Scores in the Northern Territory on this index were lower, but still well above the OECD average. Students in the Australian Capital Territory achieved the highest Australian result on the reading engagement index, significantly higher than the OECD average, while students in Victoria, Queensland and Western Australia achieved the lowest Australian results on this index, significantly lower than the OECD average.

Summary

Australian results derived from the PISA sample classified in several ways are presented and discussed in this chapter. Most attention is paid to achievement results in reading, mathematical and scientific literacy, but reference is made to other variables such as socioeconomic status and some of the attitudinal variables. Various characteristics of schools and students, including attitudinal variables, are the focus of Chapter 6 and socioeconomic status is the focus of Chapter 7.

Nationally, three-quarters of the sampled students were in Year 10, about a sixth were in Year 11 and a tenth in Year 9, though there were differences by state in the distributions by year level, as expected because of different school starting age policies. There was an imbalance of about 2.5 per cent in the distribution of males and females in the sample (more Australian males than females participated in PISA, due to the pattern of refusals from single-sex schools), but this was within the limits of sampling error. The disparity was greatest in Victoria (58 per cent male, 42 per cent female).

Students in each of the Australian states performed at least as well as, and in several states better than, the OECD average in each domain. In both reading and mathematics, students from the Australian Capital Territory, New South Wales and Western Australia performed on a par with the highest-achieving country (Finland in reading, Japan in mathematics). Students from South Australia also performed at this level in reading. In science, students from the Australian Capital Territory, Western Australia and South Australia performed on a par with the highest-achieving countries (Korea and Japan).

Within Australia, results in mathematical literacy were the most uniform across the country, with only four of a possible 28 comparisons showing significant differences in achievement. In each of reading and scientific literacy, nine of 28 comparisons showed significant differences between the states' results. In all domains the Northern Territory's result was significantly below the results from several other states. Other comparisons were mixed, though the Australian Capital Territory achieved the highest actual estimate in all three domains. Significant differences in the students' socioeconomic backgrounds were also found between some of the states, which would go part way towards explaining the achievement differences. This issue is dealt with in Chapter 7.

Five levels of proficiency in reading were defined, as seen in Chapter 3, with Level 5 being highest. The percentages of Australian students placed at Level 1 or below across the Australian states were close to the overall average of 12 in all states except Tasmania and the Northern Territory, where the percentages were 19 and 23, respectively. Thus, about a fifth of the students in those two jurisdictions could not do more than the simplest reading tasks in the PISA assessment (see Chapter 3 for examples of tasks). Tasmania was similar to the other states in the percentage of students reaching the highest two proficiency levels, but the Northern Territory had a deficit of 10 per cent or more, compared with the other states, of its students at the highest two levels.

Gender differences in reading achievement permeated the Australian states, as they did internationally, with females performing significantly higher in almost all cases. Within Australia, the 'gender gap' in reading performance was close to 50 scale points (approximately half a standard deviation) in Queensland and Tasmania.

About 500 Indigenous Australians participated in PISA, 200 of whom were part of the main sample. An additional 300 Indigenous students were oversampled from the PISA schools as an optional component undertaken in Australia. There was no significant difference in achievement between the additional and main sample students, though the main sample students achieved slightly higher actual estimates. In all three domains the Indigenous students' performance was significantly and substantially lower than the performance of non-Indigenous students. In contrast with the results for Australia as a whole, 35 per cent of the Indigenous students were placed at Level 1 or below in reading proficiency, but about 15 per cent demonstrated high levels of reading proficiency, placing them at Level 4 or 5.

Students whose main home language was not English performed at a significantly lower level than those whose main language was English in both reading and scientific literacy but there was no difference in these groups' performances in mathematical literacy. The reading load in setting the contexts for the PISA 2000 science items was high. PISA would give a clearer picture of scientific literacy skills if the reading load could be kept to a lower level, especially when science is the major assessment domain.

Finally, the Australian PISA results were examined according to whether the schools were located in urban areas, provincial cities, other regional areas and remote areas. Except in mathematics, students attending schools in remote areas achieved significantly lower results than students attending schools in all other areas. Students attending schools in provincial cities achieved on a par with students whose schools were in major urban areas.

The findings of most significance from a policy point of view arising from the results in this chapter appear to be the lower reading literacy skills of males compared with females, especially in Queensland and Tasmania where the difference in performance was about twice that in some of the other states. The lower performance of Indigenous students than non-Indigenous students in all domains is also an enduring concern. However, the fact that 40 per cent of the Indigenous students demonstrated reading literacy skills at or above Level 3 in proficiency suggests that this proportion of the Indigenous population has a more than adequate level of skills to help them in their future lives, an encouraging sign.

Chapter **SIX**

THE CONTEXTS OF PISA IN AUSTRALIA: PRIORITIES, SCHOOLS AND STUDENTS

The purpose of this chapter is to describe several characteristics of the schools and students who took part in PISA and to highlight those variables which are most likely to have an impact on or be associated with achievement. Factors such as school environment, instructional practices, students' attitudes and home background have been shown in other studies (for example, in the Third International Mathematics and Science Study (TIMSS)) to be related to achievement. These constructs are worth examining in attempting to understand education in a broader context. Secondly, measures of these factors in PISA 2000 provide a baseline from which further comparisons can be made in the next and future PISA cycles.

>> *International and national priorities for PISA 2000*

In developing the School and Student Questionnaires the Board of Participating Countries, guided by earlier work done by the OECD's Network A (see Appendix 1), recommended sets of priorities. For the School Questionnaire, the main priorities were:

- Quality of the school's human and material resources;
- School-level socioeconomic status;
- School-level variables on instructional context;
- Institutional structure;
- School size; and
- Parental involvement.

The main priorities set for the Student Questionnaire, with the intention of having an in-depth measure of socioeconomic factors, were:

- Basic demographics (such as age and sex);
- Socioeconomic background;

- Students' descriptions of school/instructional processes;
- Students' reading habits and attitudes towards reading;
- Students' access to educational resources outside school;
- Students' educational pathways;
- Home language background;
- Country of birth; and
- Students' educational and occupational expectations.

Two additional components were included in the Student Questionnaire. These relate to the options, encouraged internationally, for collecting data on Familiarity with Information Technology and on Cross Curriculum Competencies (CCCs). Student responses relating to these areas have been included in this chapter, under the relevant sections.

Within Australia, a specially convened group, the Indigenous Education Consultative Group, produced a set of priorities that were considered to be important for Indigenous students. Almost all of these could also be applicable to other students, and approval was therefore sought from the International Project Centre at ACER to include them in Australia's Student Questionnaire. The priorities were:

- Indigenous status;
- Fluency of spoken English;
- Time spent in various out-of-school activities;
- Travelling time to school;
- Absences from school; and
- Educational aspirations.

Some of the topics identified at international level were eventually not included in the Student Questionnaire for reasons of time – very little was included on educational pathways, and educational aspirations were not asked for in other countries.

Most of the questionnaire items are listed in Appendix 4, together with an indication of how they have been combined into scales for analysis purposes.

>> *Questionnaire response rates*

An excellent response rate was obtained on the School Questionnaire, with all participating schools sending back a completed copy. Schools with more than one campus (if in different locations) were asked to provide information for the campus where the assessment was taking place.

The Student Questionnaire was administered following the completion of the achievement booklet, except in two schools where it was administered in a later session. There were 36 students who responded to the test but did not complete a questionnaire. These students were scattered throughout various schools.

The percentages of missing data ranged from the zero to 16 per cent of students not being able to provide information on the number of class periods per week in their school program and/or in particular subjects. Percentages of missing responses have been included in the discussion of items where appropriate. Data in figures and tables are in percentages and all analyses in this chapter are based on weighted data unless stated otherwise.

>> Australian school and student participants

Material in this section is reported by topic, arranged so that information about schools is presented first within a topic where applicable, followed by information about the students. Background characteristics of the participating PISA schools and students are described first. This is followed by a discussion of instructional practices (including instructional time and teacher attitudes) at school level, and students' patterns of participation in various school programs, their reading habits and attitudes towards reading, their educational aspirations, familiarity with technology, and learning preferences and behaviours.

In some cases both the principal and students answered questions on the same variables – on instructional practices, for example – which provided a more comprehensive picture than if the information came from only one source.

Descriptive information on PISA schools

School sample

In Chapter 2, Table 2.2 shows the distribution of the 231 schools that participated in the Australian PISA sample for the main survey in 2000. The schools came from all states and territories and all sectors. The numbers of schools were selected proportional to state enrolment size and in the correct ratios for the government, Catholic and independent sectors.

Year levels catered for

About 60 per cent of the PISA schools catered for the full span of secondary year levels. A further 16 per cent catered for lower to mid-secondary levels and slightly smaller percentage catered for both all primary and all secondary levels.

The remaining nine per cent of schools had a range of structures: full primary to mid-secondary; mid-primary to upper secondary; upper primary to full secondary; mid-primary to mid-secondary and Year 11 and 12 only.

School composition

Two hundred of the 231 PISA schools (87 per cent) were coeducational. Single sex schools, of which a fifth were government schools, constituted the remainder, with an equal percentage of male only or female only schools (but these were distributed unevenly by state).

School location

The Australian School Questionnaire used some different and additional categories from those used internationally to identify the communities in which schools were located, to provide a broader range of community size. For example, in the international version, the category of 'town (15 000 to about 100 000 people)' was expanded in the Australian questionnaire to 'a larger town (15 000 to about 50 000)' and 'a very large town (50 000 to about 100 000 people)'.

Figure 6.1 shows the distribution of PISA schools across rural and metropolitan areas according to the principals' responses. Over sixty per cent of schools were

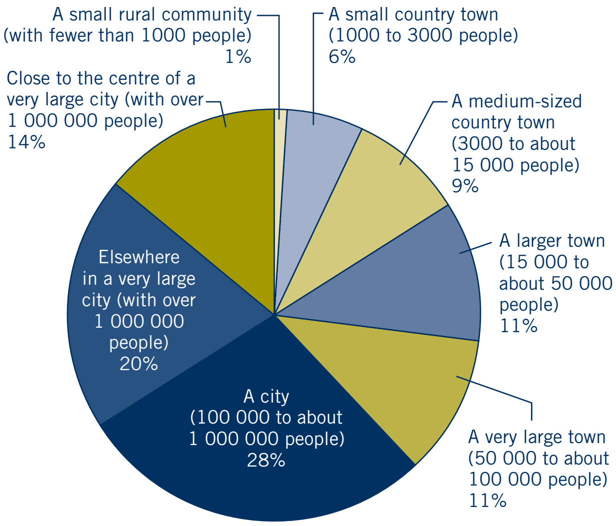


Figure 6.1 Locality of PISA schools

located in cities with more than 100 000 people. A further third of schools were located in medium, large or very large towns, containing between 3000 and 100 000 people. Fewer than seven per cent of schools were located in small country towns or small rural communities. These responses make sense in relation to the distributions according to categories provided by the Australian Bureau of Statistics, as shown in Tables 5.11 and 5.12 in the previous chapter.

School enrolment size

The responses provided from principals about their school enrolment size are shown in Figure 6.2. School size ranged from 100 to 1939 students. The average size of PISA schools was 798 students. Two per cent of schools had fewer than 200 students, a fifth of schools had between 201 and 500 students and almost a third of schools had between 501 and 800 students. School sizes between 801 and 1100 constituted a third of PISA schools and about 18 per cent of schools had more than 1100 students.

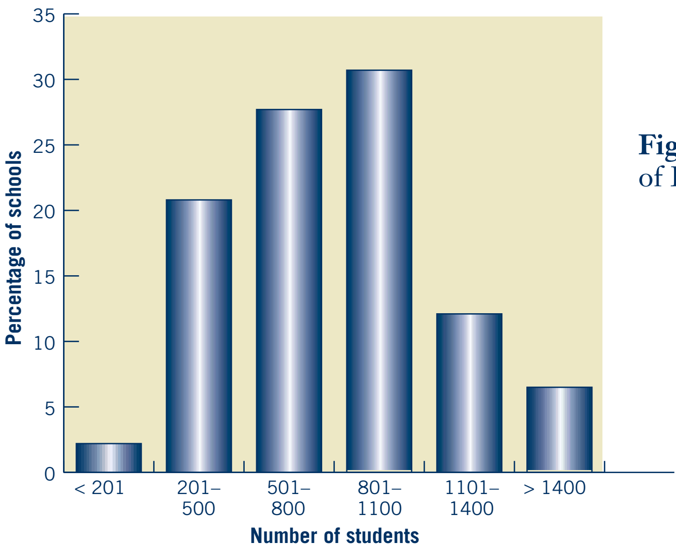


Figure 6.2 Enrolment Size of PISA Schools

Teachers in the school

The total number of full-time classroom teachers ranged from three to 120, with an average of 53 teachers. Six per cent of schools did not employ part-time[1] teachers. On average, there were 10 part-time teachers per school, with one school reporting as many as 54 part-time teachers.

[1] As specified by the OECD, teachers were considered to be part-time classroom teachers if they spent less than 90 per cent of their time in teaching classes.

The ranges of English, mathematics and science teachers employed on a full-time basis were very comparable. The maximum number of English and mathematics teachers per school was 45, and the maximum number of science teachers was 40. The mean numbers per school for the English, mathematics and science full-time teachers were 11, 10 and 9, respectively.

There were up to 10 English, 16 mathematics and five science teachers per school in part-time class teaching roles, with means of two part-time English teachers, one part-time mathematics teacher and one part-time science teacher.

Descriptive information on PISA students

Gender

As outlined in Chapter 5, there was an imbalance in gender representation, with more males (52.6 per cent) than females (47.4 per cent) participating in PISA. A difference of this magnitude is well within sampling error. The tendency for a higher proportion of males than females was also found in Victoria and Western Australia, with 15 and 10 per cent more male students in their PISA samples, respectively. The imbalance can be accounted for by differences in the numbers of participating single sex boys' and girls' schools per state. The Australian Capital Territory, New South Wales and Queensland had equal numbers of boys' and girls' schools involved but the other states had unequal numbers. Victoria had the highest representation of boys' schools. To some extent the imbalance of single sex schools was a result of high-achieving girls' schools not wishing to have their students, especially their Year 11 students, miss school time by spending a morning taking part in a survey. There was no single sex school from the Northern Territory. Table 6.1 provides a breakdown of students by gender, with the percentage and weighted number of students for Australia and by state and territory provided.

Table 6.1 Student Distribution by Gender and by State/Territory

State/ Territory	Female (%)	Male (%)	Female (weighted no. of students)	Male (weighted no. of students)	Total (weighted no. of students)*
NSW	49.3	50.7	37 503	38 524	76 027
VIC	42.4	57.6	24 225	32 952	57 177
QLD	49.8	50.2	20 493	20 671	41 164
SA	53.1	46.9	9 146	8 070	17 216
WA	44.9	55.1	10 721	13 172	23 893
TAS	48.3	51.7	3 014	3 189	6 203
NT	50.4	49.6	831	812	1 643
ACT	50.9	49.1	2 193	2 113	4 306
TOTAL	47.4	52.6	108 126	119 503	227 629

* There were a few students with missing data on this variable, which accounts for the slightly different weighted totals than in tables reporting the totals for the full sample.

Age

As mentioned in Chapter 1, in order to be eligible to participate in PISA in Australia, a student was required to have been born between 1 May 1984 and

30 April 1985. The average age of the PISA participants was about 15 years and 8 months and was uniform throughout the states and territories.

Year level and program of study

As the age distribution of students varies by year level in the states and territories, it was necessary to draw the PISA sample from more than one year level to ensure coverage of all age-eligible students enrolled in Australian educational institutions. Nationally, three quarters of the participating PISA students were in Year 10. The majority of students from all states and territories were also undertaking Year 10, except in Western Australia, where the participants were evenly divided between Year 10 and 11 (Table 6.2).

The remaining students came from Year 11 (17 per cent), Year 9 (7 per cent) and a very small percentage from Year 8 (0.1 per cent). The distribution for the country as a whole was as expected according to the Australian Bureau of Statistics figures included in Appendix 2. Table 5.1, in Chapter 5, provides details on the differences between the Australian states in age of entry to school.

Table 6.2 Distribution of Students by Year Level and by State and Territory#

State/ territory	Year level (%)				
	8	9	10	11	Missing
NSW		8	86	5	1
VIC	*	13	81	5	*
QLD		1	57	42	*
SA		3	79	17	1
WA		1	49	49	1
TAS		7	84	8	1
NT	*	6	80	13	1
ACT		7	92	*	1
AUS	*	7	76	17	1

The percentages are based on weighted data; state and territory totals may not add to 100 because of rounding.
* Percentage < 0.5

Of the students in Year 9 or Year 10, three quarters were in a general academic program and a quarter were in a general academic program with some VET subjects. Of the students in Year 11, 71 per cent were in a program leading to a university course, 15 per cent were in a program leading to an apprenticeship and 14 per cent were in a program with mostly VET subjects designed to allow entry to a job from school.

Parents' occupations and education

Students were asked to complete questions about the occupation and attained educational level of their mother and father (and/or primary caregiver where relevant). Discussion and analyses pertaining to the questions on occupations, and the derived International Socio-economic Index, are not included here as they are a focus of Chapter 7.

The patterns of educational attainment for mothers and fathers were very similar (Table 6.3). A very small percentage, fewer than four per cent, of parents had had no or no more than primary school education. Of the parents who had attended secondary school, approximately a quarter had completed no more than Year 10, a sixth had completed either Year 10 or Year 11 and a training course (for example, business studies, an apprenticeship or nursing), and a further fifth of parents had finished their education at Year 12. A third of parents had attended university.

There were very small or no differences between the percentages of mothers and fathers in each of the attained educational levels. The data also show that students were more familiar with their mother's educational attainment than their father's.

Table 6.3 Distribution of Parents' Education Levels

Attained educational level	Parent (%)	
	Mother	Father
No schooling	1	1
Completed primary school only	2	3
Completed no more than Year 10	25	23
Completed Year 10 or Year 11 plus training course	15	15
Completed Year 12	23	21
Undertook tertiary education	30	31
Missing	4	6

A summary variable was created for parents' education by using the higher of the mother's and father's education levels. The percentages of students for each level of this variable are shown in Figure 6.3, joined by lines to assist viewing. The percentages of students with parents who had no or no more than primary education were very similar across the states and territories, but there was more variation for parents with no more than secondary education or completing no more than Year 10 or 11. There was a slightly higher percentage of the parents who completed Year 12 in Western Australia, South Australia and Queensland than in other states. The Australian Capital Territory had a much higher percentage of students with parents who completed tertiary education than in the other states and territories.

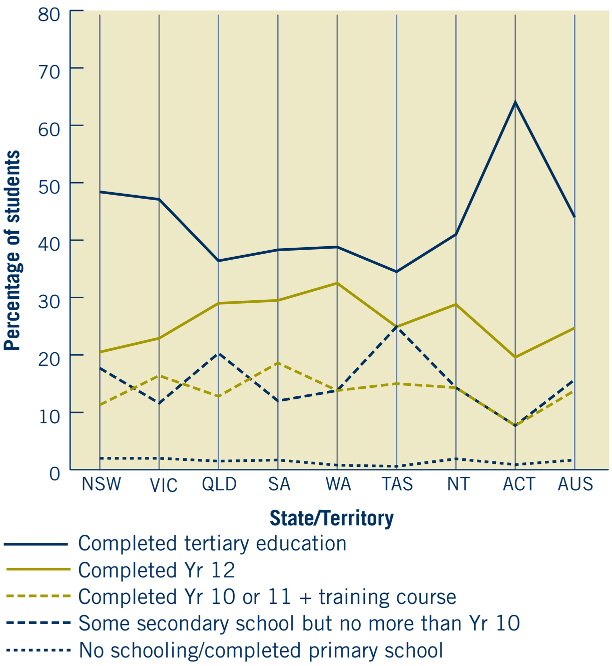


Figure 6.3 Higher of Parents' Education Levels by State and Territory

Table 6.4 shows the mean reading literacy achievement, by state and territory, of students who had one or both parents with a university education. The analysis revealed that students from the Australian Capital Territory with parents who completed university studies performed better on average than students in the other states and territories with parents in this category. The questionnaire item did not ask whether the university education completed included postgraduate studies, the incidence of which is likely to be higher in the Australian Capital Territory than elsewhere.

Table 6.4 Reading Achievement and Parents' Completion of Tertiary Education by State and Territory

State/territory	Mean reading achievement
NSW	567
VIC	541
QLD	560
SA	569
WA	568
TAS	555
NT	509
ACT	577

Family type and size

Almost three quarters of the students who participated in PISA came from a nuclear family, that is, consisting of both parents and one or more children. The remaining students came from a single parent family (16 per cent), a mixed family (9 per cent) or another type of family structure (3 per cent).

On average, the PISA students had two siblings. Five per cent of the students had no siblings, a third had one sibling and a further third had two. Sixteen per cent had three siblings and the remaining students had four or more.

Thirty-six per cent of students were the first-born children in their family, and 26 per cent and 34 per cent were the second- and third-born, respectively.

Figure 6.4 shows the relationship between reading achievement and family type. Students who came from a nuclear family performed better than students from other family structures did.

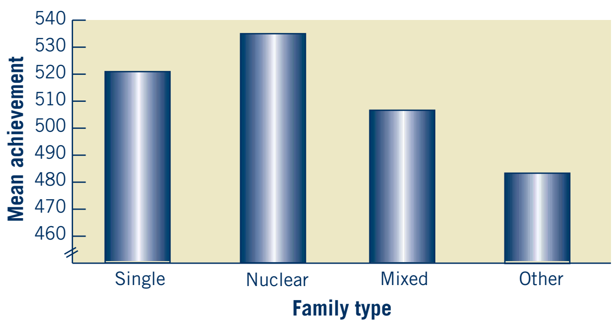


Figure 6.4 Reading Achievement and Family Type

Aspects of ethnic background

Country of birth

Data on country of birth was collected in the Student Questionnaire for the students and their parents, as well as on language spoken at home most of the time. Fewer than 2 per cent of the students failed to complete these items. Eighty-seven per cent of students, 69 per cent of mothers and 67 per cent of fathers were born in Australia. Close to two and a half per cent of students identified themselves as Indigenous. The percentages of students and parents who were born in Australia or another English speaking country – for example, New Zealand, England or the United States – are shown in Table 6.5. From 89 to 98 per cent of students were born in an English speaking country, depending on state – Tasmania had the highest percentage and New South Wales and Victoria shared the lowest percentage. For both mothers and fathers, the lowest percentages occurred in Victoria.

Table 6.5 Distribution (%) of Students and Parents Born in Australia or another English Speaking Country, by State and Territory

State/territory	Student	Mother	Father
NSW	89	78	77
VIC	89	73	71
QLD	95	89	90
SA	93	81	80
WA	95	86	85
TAS	98	94	94
NT	94	79	77
ACT	91	79	80
TOTAL	91	81	80

Twenty-three per cent of students had two parents who were born in a country other than Australia and 19 per cent of students had one parent born overseas and one born in Australia. Table 6.6 shows the percentages of students and parents who were born in a non-English speaking country. The highest percentages of students and mothers were born in an Asian country. There were more fathers born in a European country than an Asian or other country.

Table 6.6 Distribution (%) of Students' and Parents' Countries of Birth, in Non-English Speaking Countries

Country	Student	Mother	Father
European	2	6	8
Asian	4	8	7
Middle Eastern	1	2	2
Other	2	3	3
Total	9	19	20

Language in the home

Eighty-three per cent of the participating students in PISA spoke only English in their home. A very small percentage (0.2) spoke an Indigenous Australian language as their main language. European and Asian languages were the next most frequently spoken main languages in the students' homes, at seven and six per cent, respectively. Fewer than two per cent of students spoke a Middle Eastern language and the remaining students spoke a language other than those already mentioned here.

States and territories with the highest percentages of students who spoke only English at home were Tasmania, then Queensland and Western Australia (Table 6.7). Victoria had the highest percentage of European and Asian language speakers, and Middle Eastern languages were spoken more frequently in the participating students' homes in New South Wales.

Table 6.7 Distribution (%) of Language Spoken at Home, by State and Territory#

State/ Territory	English only	Indigenous	European	Asian	Middle Eastern	Other
NSW	81	-	6	8	4	1
VIC	75	-	13	9	2	2
QLD	92	*	2	3	*	3
SA	83	*	9	6	*	1
WA	90	*	4	3	1	2
TAS	96	*	2	2	*	*
NT	81	5	5	8	*	1
ACT	85	*	5	5	1	3
TOTAL	83	*	7	6	2	2

State and territory totals may not add to 100 because of rounding.
* Percentage < 0.5

Students who spoke a language other than English at home were asked to indicate how well they spoke English. About two-thirds of the students said they spoke English 'very well', and a further quarter said they spoke it 'well'. Only five per cent of students considered that they did not speak English fluently.

Family possessions

Two questions in the Student Questionnaire related to household possessions. The first question provided a list of items found in homes and asked students to indicate whether they had the items in their home or not. The second question, also providing a list of items, asked students to mark the appropriate category, from none to three or more, to show how many of each item they had in their home. Responses to these questions were used as proxy measures of family wealth and of the extent of educational resources available to students.

Almost all students (99 per cent) had a dictionary, 93 per cent of students had school textbooks, and a large majority of students (90 per cent) had a room of their own, a desk for studying and a quiet place to study. About seventy per cent of students had three or more calculators in their home, a fifth of students had two calculators, six per cent had one calculator and only one per cent of students did not have a calculator in their home. There was a positive relationship between the extent of home educational resources and reading achievement, with a correlation coefficient of 0.23.

Although 72 per cent of students indicated they had works of art, for example, paintings, in their home, fewer had books of poetry and literary works (53 and 42 per cent, respectively). The relationship of these cultural items with reading achievement is provided in Figure 6.5. The correlation coefficient of 0.32 showed one of the highest relationships of a background variable in relation to achievement.

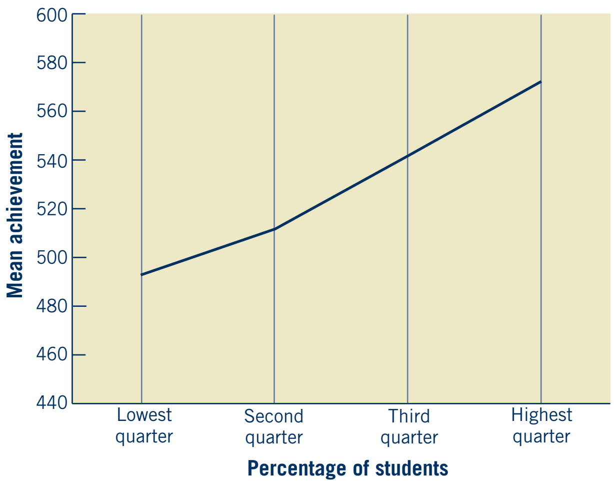


Figure 6.5 Reading Achievement and Possession of Cultural Items Scale[2]

Half the students had a computer in their home, a further quarter had two computers and a further 12 per cent had three or more computers in their home. Eighty-two per cent of students had educational software at home and two thirds of the students had a link to the Internet. Only nine per cent of students did not have at least one computer in their home.

The majority of homes had at least one television set. Half the students had three or more, 36 per cent had two and 13 per cent lived in a home with only one television set. The percentages of students having from one to three or more mobile phones were roughly similar to those for television sets.

Several composite scales were derived from the Student Questionnaire data (see Appendix 4 for details). One scale, *family wealth*, was composed of nine items (dishwashing machine, room of your own, educational software, link to the Internet, and numbers of mobile phones, televisions, computers, motor cars and bathrooms). Figure 6.6 shows a positive though weak correlation (r = 0.14) between reading achievement and the distribution of students into quarters on this scale. Students with more of these items in their home performed better than students with fewer of them.

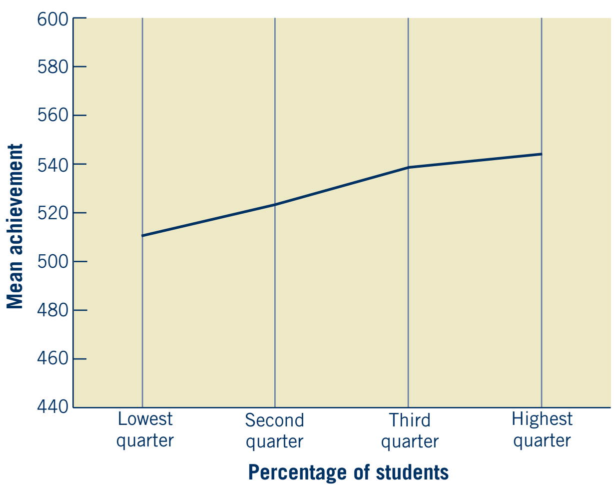


Figure 6.6 Reading Achievement and Family Wealth Scale[3]

[2] These data were obtained from the PISA international report (OECD, 2001).
[3] These data were obtained from the PISA international report (OECD, 2001).

Instructional practices and school climate factors

Instructional time

Information on instructional time – the number of instructional weeks in the school year, number of class periods per week and the length of a class period – was obtained from the School Questionnaire.

In Australia, the average number of instructional weeks in the school year was 40 and varied by less than a week, on average, from state to state. Although the average number of instructional class periods per week for 15-year-olds was just over 30, there was larger variation, from an average of 27 periods in the ACT to almost 31 in South Australia, between the states and territories on this variable than there was for instructional weeks. It is important to note that the schools with fewer class periods per week also tended to have longer class periods. Western Australia had the longest class periods on average (about 56 minutes) and Tasmania had the shortest (just under 50 minutes per period).

Fifteen-year-old students in Western Australia spent the longest time in instruction per week, as reported by principals, with an average of more than 26 hours per week. This was followed by 26 hours per week in South Australia, the Northern Territory and New South Wales, and 25 hours per week in Victoria and Tasmania. The Australian Capital Territory and Queensland recorded the lowest number of instructional hours, with 24 hours per week each. Nationally, 15-year-old students spent, on average, 26 hours per week in instruction.

Students were asked about the number of class periods they had for English, mathematics and science. This question produced the highest amount, 16 per cent, of missing data. Nationally, for the students who answered the question, the average number of English, mathematics and science classes each week was five, five and four, respectively. The Australian Capital Territory, Queensland, South Australia and Tasmania had, on average, four English classes each week. Other states and territories had an average of five classes per week.

The average number of mathematics classes each week was five, except in the Australian Capital Territory where the average was four classes per week. For science, there was an average of four classes each week except in New South Wales and Western Australia, which had an average of five classes per week.

Classroom environment and other instructional practices

The classroom environment is another dimension that helps in understanding student performance. Information about the occurrence in English lessons of a range of activities was collected in the Student Questionnaire. Sixteen statements provided data on the students' perceptions of classroom practices in three areas – teacher support, the disciplinary environment of the classroom and teacher emphasis on student performance.

Students indicated that activities relating to teacher support occurred in most or every English lesson. About 80 per cent of students indicated that their teachers helped them with their work, provided them an opportunity to express their opinions or helped them in other ways with their learning. Over 70 per cent of students indicated that their teachers showed an interest in their learning, helped them 'a lot', and continued to teach until students understood, as shown in Table 6.8.

Table 6.8 Percentages of Students Indicating the Frequency of Activities Relating to Teacher Support in English Lessons

	Never	Some lessons	Most lessons	Every lesson
The teacher shows an interest in every student's learning.	5	22	32	41
The teacher gives students an opportunity to express opinions.	5	17	30	48
The teacher helps students with their work.	2	17	32	49
The teacher continues teaching until the students understand.	5	23	35	37
The teacher does a lot to help students.	5	24	37	34
The teacher helps students with their learning.	3	20	36	41

There was a low positive relationship (r = 0.07) between teachers demonstrating supportive and encouraging behaviours in English lessons and students' reading achievement. Figure 6.7 shows the extent of relationship between reading achievement and the frequency of teachers' providing students with an opportunity to express their opinions in English lessons (one of the items that make up the *teacher support* scale. The United Kingdom, Portugal and Australia had the highest mean results of any country on this scale, well above the OECD average.

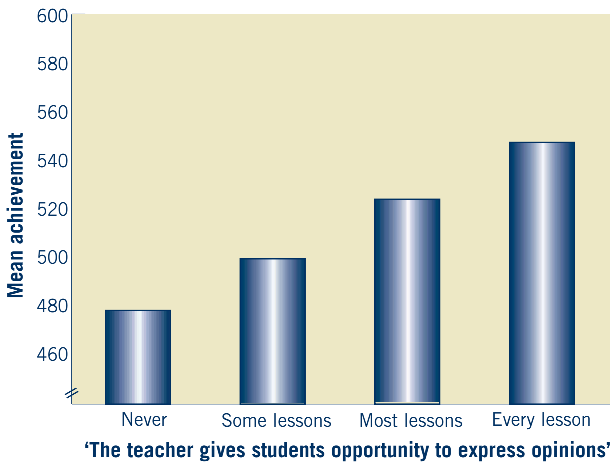


Figure 6.7 Reading Achievement in Relation to Teachers' Supporting Students in English Lessons

Students were asked about the frequency of classroom disruptions. A fifth of students indicated that, at the start of every lesson, at least five minutes was spent doing nothing. Thirteen and 11 per cent of students, respectively, indicated that in every lesson there was noise and disorder and that the teacher had to wait a long time for students to settle down. Table 6.9 shows that between 44 and 66 per cent of students perceived that disruptive behaviour occurred most commonly in some lessons rather than in most or every lesson.

Students who were well behaved and cooperated with teachers were more likely to achieve better results than students who were disruptive in the classroom. The relationship between reading achievement and incidence of teachers waiting for students to settle down is shown in Figure 6.8. On the full disciplinary climate scale, there was a negative relationship between disruptive behaviour and reading achievement (r = -0.15). Australia's result on this scale was close to the OECD average.

Table 6.9 Percentages of Students Indicating the Frequency of Behaviours Relating to the Disciplinary Environment in English Lessons

	Never	Some lessons	Most lessons	Every lesson
The teacher has to wait a long time for students to settle down.	9	60	20	11
Students cannot work well.	16	66	14	4
Students don't listen to what the teacher says.	12	66	15	7
Students don't start working for a long time after the lesson begins.	14	60	18	8
There is noise and disorder.	12	56	19	13
At the start of the lesson, more than five minutes are spent doing nothing.	14	44	22	20

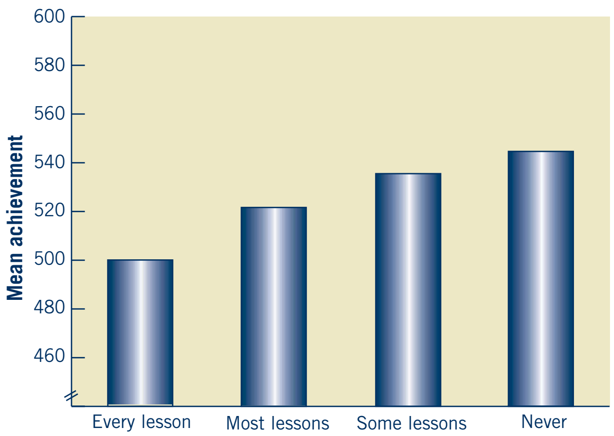


Figure 6.8 Reading Achievement in Relation to Classroom Disciplinary Environment in English Lessons

Table 6.10 shows the frequency of student responses to items on teachers' emphasis on student performance. While these items supposedly constitute a scale of *achievement press* (see Appendix 4), they were answered inconsistently in Australia. While 86 per cent of Australian students perceived there was an expectation from their teacher for them to work hard in most or every lesson, fewer than half said their teacher told them they could do better in most or every lesson. There was also the expectation that teachers preferred work to be carefully done, with 58 per cent of the students indicating this occurred in most or every lesson. The correlation of achievement press with reading achievement in Australia was -0.09.

Table 6.10 Percentages of Students Indicating the Frequency of Behaviours Relating to Teacher Emphasis on Performance in English Lessons

	Never	Some lessons	Most lessons	Every lesson
The teacher expects students to work hard.	1	13	42	44
The teacher tells students that they can do better.	8	50	28	14
The teacher does not like it when students hand in careless work.	6	36	31	27
Students have to learn a lot.	5	41	39	15

Teacher morale

Principals responded positively or very positively to the following statements relating to the morale of teachers in their schools:

- Teachers value academic achievement.
- The morale of the teachers in this school is high.
- Teachers work with enthusiasm.
- Teachers take pride in this school.

Almost all principals (98 per cent) agreed or strongly agreed that teachers in their school valued academic achievement and worked with enthusiasm. A slightly lower percentage agreed or strongly agreed that teacher morale in the school was high – only 13 per cent of principals disagreed or strongly disagreed that teacher morale was high in their schools. Approximately half the principals agreed and 40 per cent strongly agreed that teachers took pride in their school.

Figure 6.9 shows the significant positive relationship between reading achievement and principals' perception of teacher morale. The mean on this scale in Australia was at the OECD average. Very high perception of teacher morale was reported by principals in Austria and Switzerland, while the opposite occurred in Italy, Korea, Poland and Portugal.

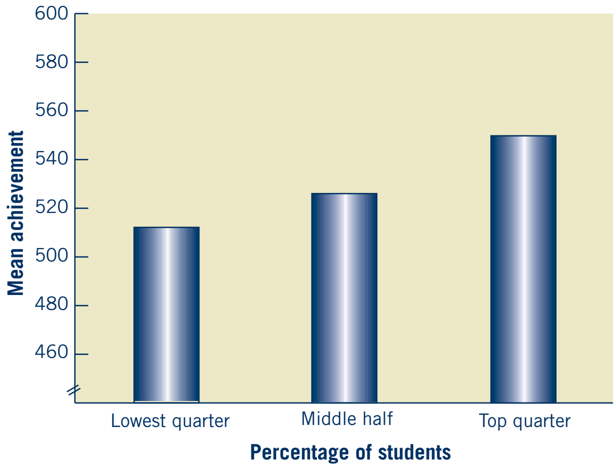


Figure 6.9 Reading Achievement and Principals' Perception of Teacher Morale[4]

Students transferring to another school

Six options were provided in the School Questionnaire for principals to indicate how likely it would be for a Year 10 student to be transferred to another school, and for what reason. Their responses are summarised in Table 6.11.

Fifteen per cent of principals reported that students were never transferred to another school. In the remaining schools, over half the principals indicated parents' or guardians' requests as the most likely reason for a student to be transferred. Behavioural problems and special learning needs were the next most common reasons, with a combined percentage of 36 per cent and 18 per cent, respectively, for the likely and very likely categories. The large majority of principals (96 per cent) considered that low or high student achievement would not be a reason for a student to be transferred to another school.

[4] These data were obtained from the PISA international report (OECD, 2001).

Table 6.11 Percentage of PISA Schools Transferring Students, and Their Reasons

	Not likely	Likely	Very likely
Parents' or guardians' request	44	43	13
Behavioural problems	64	34	2
Special learning needs	82	17	1
Low academic achievement	96	4	0
High academic achievement	96	4	0
Other	79	17	4

Other school factors

Data on many other factors relating to school conditions were collected in the School Questionnaire. A cross-section of those identified in the PISA international report (OECD, 2001) as being related to reading literacy achievement in several countries is briefly discussed here. The variables are all described in Appendix 4.

Principals' perceptions of teacher-related factors affecting school climate

The PISA index of teacher-related factors affecting school climate was derived from perceptions that students' learning was hindered by teachers' low expectations of them; poor teacher-student relations; teacher absenteeism; teachers resisting change, and so on. The index of these factors was significantly related to reading literacy achievement in 14 countries, including Australia.

Teacher shortage

An index of teacher shortage was created to reflect the principals' view on how much students' learning was affected by shortage or inadequacy of their test language, mathematics or science teachers. Low values indicate problems with teacher shortage. A significant relationship was found in Australia, and in 14 other countries, between teacher shortage and reading literacy achievement.

Quality of a school's physical infrastructure

Principals' responses to whether students' learning was hindered by poor condition of school buildings, poor heating, lighting and cooling systems, and shortage of classrooms defined the index of quality of physical infrastructure. This index was not related to reading literacy achievement in Australia.

Quality of a school's educational resources

An index of quality of educational resources was derived from principals' reports on whether students' learning was hindered by insufficient computers, lack of instructional materials, lack of multi-media resources, inadequate laboratory equipment, and so on. This index was significantly related to reading literacy achievement in 15 countries, including Australia.

School enrolment size

For schools up to 1000 students in size, there was a weak positive relationship in the OECD as a whole between size and reading literacy achievement – an increase of 100 students was associated with an increase in reading scores of about 4 scale points. Beyond 1000 students, the relationship was much less.

The school factors mentioned here, among other factors, are considered jointly in relation to achievement in Chapter 8.

Students' patterns of participation and program orientation

Students' selection of subjects

Principals were provided with a list of different factors that could determine subjects taken by Year 10 students. Students' choice was the most important factor, with three-quarters of the principals indicating that this was very important and another quarter indicating that it was important.

A parent's or guardian's request was the next most important factor, with a third of the principals endorsing this as very important. A quarter of the principals indicated that a student's previous academic record was very important, and a fifth suggested that teachers' recommendations were very important. Larger numbers of principals, between sixty-three and seventy-one per cent, considered parents' or guardians' requests, students' previous academic records and teachers' recommendations to be important.

A placement examination was considered by over 90 per cent of principals to be the least important factor in determining the subjects taken by Year 10 students.

Additional courses

The information reported by principals about additional courses showed that their schools were more likely to provide assistance for low-achieving students than for gifted students. Sixty-four per cent of schools offered extra courses in academic subjects for gifted students, but about 90 per cent provided special instruction in English for low achievers and about 70 per cent provided special courses in study skills for low achievers. Half the schools provided rooms where the students were able to do their homework with staff assistance and three-quarters of the schools offered special tutoring by staff.

A very small percentage of students indicated that they had regularly attended a special course at their school to improve their results. This consisted of extension or accelerated courses (7 per cent), courses to help with learning difficulties in English and other subjects (2 per cent), and training to improve their study skills (3 per cent). Similar percentages of students undertook a course in English outside of their school but twice as many students sought extra courses in other subjects outside the school. Almost a tenth of students reported having private tutoring.

Internationally, there were some very high percentages of students who reported that they sometimes or regularly attended extension or additional courses in the language of the test or in other subjects. These ranged from highs of 71 per cent in Japan and 64 per cent in Korea, to 51 per cent in Mexico and Poland, down to 8 per cent in Sweden, 7 per cent in Switzerland and 6 per cent in Italy. There were also high percentages of students in Korea (58 per cent), Spain (55 per cent) and Poland (53 per cent) who said they sometimes or regularly attended remedial courses. Extending the responses to students reporting they sometimes attended extra courses in Australia brings the incidence of attendance at extension and remedial courses to 23 and 32 per cent, respectively.

Students' educational aspirations

Students in Australia were asked about their future educational plans (this question was not used internationally). Almost 90 per cent of the students, with equal percentages of males and females, said they planned to complete Year 12. Five per cent planned to finish their schooling at Year 11 and eight per cent planned to complete no more than Year 9 or 10. Two-thirds of those saying they planned to complete no more than Year 9, 10 or 11 were males.

Approximately 60 per cent of the students intended to undertake tertiary studies. Eighteen per cent expected to complete a 5- or 6-year degree and six per cent planned to undertake a Masters or a PhD degree. Almost forty per cent of students indicated that they did not intend to go to university. Six per cent of students were not planning to undertake any further formal education, 12 per cent intended to finish an apprenticeship and a fifth said they intended to complete a TAFE certificate or diploma.

Table 6.12 shows the percentages of males and females and their educational aspirations. There were more males than females intending to complete an apprenticeship or a Masters or PhD degree, or to undertake no further studies. More females than males planned to finish a TAFE certificate or a 3- or 4-year university degree.

Table 6.12 Males' and Females' Educational Aspirations Beyond Secondary School

	Females' (%)	Males (%)
No education beyond school	5	8
Finish an apprenticeship	5	19
Finish a TAFE certificate	23	17
Finish a 3- or 4-year university degree	42	32
Finish a 5- or 6-year university degree	20	17
Finish a Masters or PhD degree	5	7

>> *Students' reading habits and attitudes towards reading*

Books in the home

The number of books in the students' homes has been a very useful predictor of achievement in many studies. Eighteen per cent of the Australian PISA students had more than 500 books in their home; about a fifth had each of 251 to 500 books, 101 to 250 books and 51 to 100 books; 15 per cent had between 11 and 50 books;

and five per cent had fewer than 10 books in their home. Students in the Australian Capital Territory had the highest and students in the Northern Territory had the lowest average number of books at home.

There was a positive relationship between reading achievement and number of books in the home ($r = 0.29$), a result which is consistent with findings from earlier studies, for example, TIMSS.

Frequency of reading

Although a wide range of reading materials was available and easily accessible to students, the students were more likely to read emails and web pages (37 per cent), newspapers (35 per cent) and magazines (28 per cent) several times a week than fiction or non-fiction books (14 and 5 per cent, respectively) and comic books (4 per cent). Magazines, newspapers, emails and web pages were also the most common reading materials students said they chose to read several times a month.

Students were less likely to choose a fiction, non-fiction or comic book to read. A fifth of students indicated that they never or hardly ever chose to read a fiction book and 27 per cent said likewise for a non-fiction book. About half the students chose to read a fiction or non-fiction book a few times a year or about once a month. Reading a comic book was also uncommon, with 60 per cent of students saying they never or hardly ever read this type of material.

Attitudes to reading

Attitudes have been shown in many studies to be an important variable in relation to achievement levels. Several items in PISA explored students' attitudes to reading. The students' responses were generally quite positive, though internationally Australia was only at the OECD average on the combined engagement with reading scale (see Chapter 2). With respect to reading, over 76 per cent of the students disagreed or strongly disagreed that they were unable to sit still and read for more than a few minutes and that they read only if they had to. Between 62 and 70 per cent of students said they liked to talk about books to other people, that reading was one of their favourite hobbies, that they were able to finish books and that they read because they wanted to. Enjoying going to a bookshop or library and being happy to receive a book as a present were reacted to less favourably, with only about half the students responding positively. A similar position was found with respect to reading only to obtain needed information. Table 6.13 shows the distribution of responses to the reading attitudinal items by gender.

It would be expected that students who have positive experiences with reading would be more likely to demonstrate higher levels of achievement in reading. Responses to the statements relating to reading being a favourite hobby; talking to other people about books; enjoying a visit to a bookshop or library; and feeling happy about receiving a book as a present each showed a positive correlation with reading achievement.

The negatively worded items: reading only if I have to; finding it hard to finish books; reading being a waste of time; reading only to get needed information; and not being able to read for more than a few minutes at a time, all behaved similarly in showing a negative correlation with reading achievement. That is, students who agreed or strongly agreed with these statements were more likely to perform at a lower level in reading than students who disagreed or strongly disagreed with these statements. Figure 6.10 provides an example of responses to two attitudinal items, one positively and the other negatively related to reading achievement.

Table 6.13 Percentages of Males' and Females' Responses to the Reading Attitudinal Items

	Strongly Disagree		Disagree		Agree		Strongly Agree	
	M	F	M	F	M	F	M	F
Reading is one of my favourite hobbies.	32	19	45	40	17	28	6	13
I like talking about books with other people.	34	18	45	42	18	35	3	5
I feel happy if I receive a book as a present.	25	14	37	34	34	44	4	8
I enjoy going to a bookshop or a library.	29	14	37	34	28	40	6	12
I read only to get information that I need.	11	18	35	48	38	26	16	8
I read only if I have to.	19	28	34	42	30	21	17	9
For me, reading is a waste of time.	26	40	44	43	18	12	12	5
I find it hard to finish books.	21	26	41	47	28	19	10	8
I cannot sit still and read for more than a few minutes.	35	42	40	41	15	11	10	6

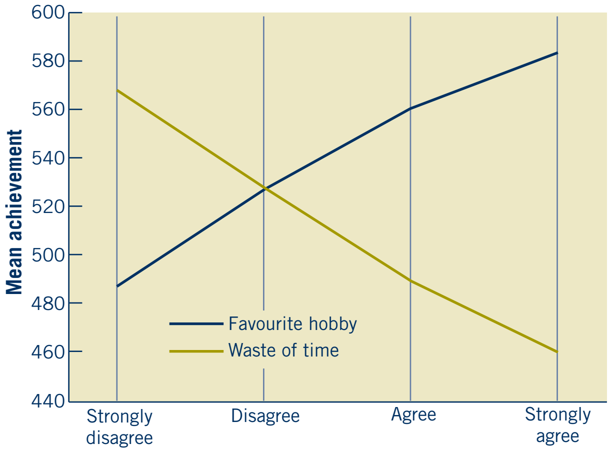


Figure 6.10 Relationship between Reading as a Favourite Hobby, and Reading as a Waste of Time, with Reading Achievement

The nine items listed in Table 6.13 formed the engagement in reading scale, and showed the strongest relationship of any scale with reading achievement (r = 0.42). Figure 6.11 shows the relationship between engagement in reading and reading achievement.

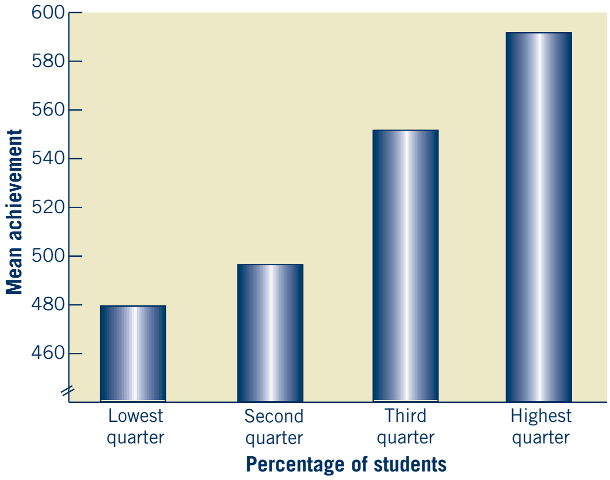


Figure 6.11 Reading Achievement and Engagement in Reading Scale[5]

[5] These data were obtained from the PISA international report (OECD, 2001).

Reading for enjoyment

Perhaps an unexpected result in PISA was the finding that a high proportion of students, particularly males, said they did not read for enjoyment. Thirty per cent of students answered that they spent no more than half an hour reading each day and a fifth said they spent between half an hour and an hour a day on reading for enjoyment. Only 16 per cent of students said they spent more than one hour reading a day and only four per cent of claimed to spend more than two hours each day on reading for enjoyment.

Figure 6.12 shows a curvilinear relationship between reading achievement and the amount of time spent on reading for enjoyment, with a correlation coefficient of 0.27 (the correlation would have been higher if the lines had not been curved). Females who read for no more than an hour each day were found to have a higher level of reading achievement than males in the same category. The difference in achievement between males and females then changed, with both males and females who said they read between one and two hours each day achieving similarly. The three per cent of males who read for more than two hours each day for enjoyment were more likely to perform better than the five per cent of females who did likewise.

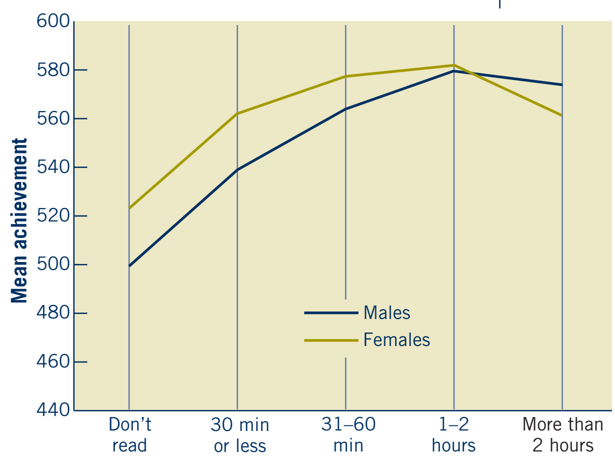


Figure 6.12 Relationship between Time Spent on Reading for Enjoyment and Reading Achievement

Interest in reading

An *interest in reading* scale was included in PISA with the Cross-Curriculum Competencies items. The items were: 'Because reading is fun, I wouldn't want to give it up'; 'I read in my spare time'; and 'When I read, I sometimes get totally absorbed'. About half the students disagreed or strongly disagreed with these statements. The size of these percentages is cause for concern, given that there was a positive relationship between reading achievement and interest in reading (r = 0.34). This raises the issue of a students' future learning – will students with little interest in reading be even less likely to read once teachers are not managing their learning?

The level of correlation of interest in reading with reading achievement is illustrated in Figure 6.13.

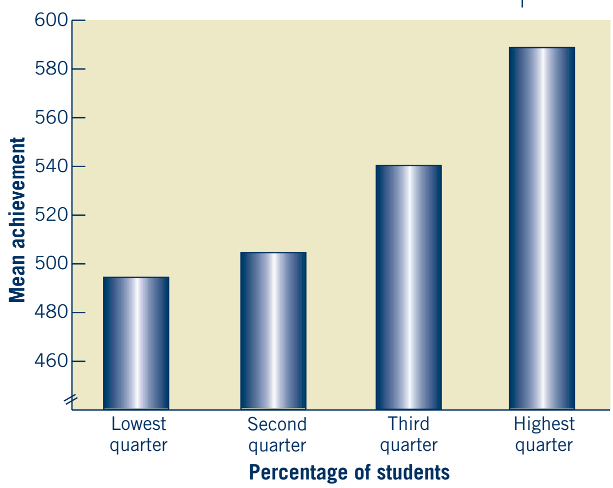


Figure 6.13 Reading Achievement and Interest in Reading[6]

[6] These data were obtained from the PISA international report (OECD, 2001).

Students' use of and attitudes towards technology

Access to computers

Computers are an important resource for students. The students were asked about availability of computers for them to use at school. Availability varied a great deal, with between 10 and 350 computers available for 15-year-olds to use, in comparison to the 20 to 1500 computers in the school altogether. On average there were 180 computers in PISA schools, with about 120 linked to the World-wide Web and 110 available to 15-year-old students.

The numbers of computers available to administration staff and teachers were much lower, with a per school average of ten computers for administration staff and 20 computers for teachers. However, principals reported a very low incidence (about four per cent) of administrative staff and teachers' not having exclusive use of a computer.

A ratio of computer availability was constructed from responses to the School Questionnaire. The range of computers available to each student in the school was between one in 10 and three for every two students, with an average of one in five. This was also the average for the proportion of computers in the school available to 15-year-olds. The highest ratio was one computer for every two 15-year-old students; and half the schools had no more than one per five students. Almost half the students had between one in five and one in three computers per student at their schools and only a small percentage of principals indicated they had more than one computer per three students available for student use.

Two thirds of the principals indicated their view that the number of computers for 15-year-olds in their schools was adequate and would not hinder the students' learning. However, a further third said there were not enough computers for instruction and this lack probably hindered the students' learning. Four per cent of principals said that the number of computers in their school was not sufficient and would definitely hinder the learning of their 15-year-old-students.

With respect to availability of computers at school, half of the students responded that they were able to access a computer on almost a daily basis, a third said they were able to access one a few times each week and 17 per cent said they were able to access one once a week or less. Students were more likely to access a computer at home than at school, in a library or another place. The majority of students had at least one computer in their home (more than 37 per cent had two or more), while fewer than ten per cent did not have a computer in their home.

Computer use

Almost half the students used their computer at home almost daily and a third used their computer a few times each week. Computer usage on a daily basis at school occurred less often than at home. Only 15 per cent of students said they used a computer every day at school, but 35 per cent said they used a computer at school a few times a week and a quarter said they used a computer at school between once a week and once a month. It is interesting to note that the percentages of students who used a computer at school were similar, whether or not they had a computer at home. Almost a tenth of students indicated they never used a computer at school and a quarter never used a computer in a library.

Students' experience with computers

Students reported using computers for a variety of reasons. They used the Internet, word processing software and electronic communication, as well as playing games and using computers to help with their schoolwork. They used software less often for other functions such as drawing and programming. Table 6.14 shows the frequency with which students said they used computers for a variety of purposes.

Table 6.14 Frequency (%) of Computer Use, by Reason

Reason for use	Almost every day to a few times each week	Between once a week and once a month	Less than once a month	Never
The Internet	66	19	10	5
Electronic communication	55	17	13	15
Playing games	45	22	19	14
Programming	27	20	20	33
Word processing	61	28	7	4
Spreadsheets	28	30	25	17
Drawing, painting or graphics	28	26	27	19
Educational software	23	29	26	22
Learning school material	42	29	17	12

Overall, 15-year-old students were familiar with using computers and had positive experiences in using them. Over 80 per cent of students indicated that it was fun to use a computer for either work or play. Two-thirds recognised the importance of using computers and just over 60 per cent indicated they used a computer because they were interested in doing this.

Internationally, as discussed in an earlier chapter, Australian students had one of the highest levels of familiarity with and comfort in using computers, well above the OECD average.

Students' learning preferences and behaviours

Students were asked to respond to several statements relating to their learning styles and abilities, with the aim of identifying whether students are likely to have the capacity to continue learning after they have left school. Several scales were created from Cross-Curriculum Competencies items to provide this information. The correlations between reading achievement and scales relating to learning preferences and behaviours are shown in Table 6.15. The scales mentioned are described in Appendix 4.

Table 6.15 Correlations between Learning Preferences and Behaviours Scales and Reading Achievement

Scale	Correlation
Use of control strategies	0.24
Use of memorising strategies	0.09
Use of elaboration strategies	0.12
Control expectations	0.22
Self-efficacy	0.23
Effort and perseverance	0.16
Instrumental motivation	0.06
Academic self-concept	0.32
Verbal self-concept	0.10
Preference for competitive learning	0.18
Preference for cooperative learning	0.05

The more important of the scales in relation to achievement, as indicated by the correlation coefficients, are discussed below, to illustrate the types of items in the scales and the nature of the students' responses. They are discussed approximately in order of the magnitude of the correlations.

Academic self-concept

Having a positive self-concept in relation to academic situations is an important characteristic for students to possess. Over eighty per cent of students agreed or strongly agreed that they learnt things quickly and were good in most school subjects, and three quarters responded positively to doing well in tests in most school subjects, as shown in Table 6.16. Students with positive perceptions of their academic abilities were more likely to perform well in reading.

Table 6.16 Percentages of Students' Responses to Statements Relating to Academic Self-Concept

Statement	Strongly disagree	Disagree	Agree	Strongly agree
I learn things quickly in most school subjects.	2	17	67	14
I'm good at most school subjects.	2	14	69	15
I do well in tests in most school subjects.	4	20	62	14

Control strategies

Over half the students indicated that when they study they often or almost always force themselves to check if they remember what they have learnt, look for additional information if they don't understand something and they try to work out which concepts they haven't understood. Sixty-four per cent of students said they often or almost always commence by working out exactly what they need to learn, and three-quarters said they make sure they remember the most important things (Table 6.17).

Table 6.17 Percentages of Students' Responses to Statements Relating to Control Strategies in Learning

When I study …	Almost never	Sometimes	Often	Almost always
… I start by working out exactly what I need to learn.	6	30	40	24
… I force myself to check if I remember what I have learned.	10	37	37	16
… I try to work out which concepts I still haven't really understood.	5	36	46	13
… I make sure that I remember the most important things.	3	22	46	29
… and I don't understand something, I look for additional information to clarify this.	7	39	38	16

Figure 6.14 shows the relationship between reading achievement and the percentage of students by quarters on the control strategies index. Students using these strategies more frequently were more likely to perform better in reading than the students who used them less frequently.

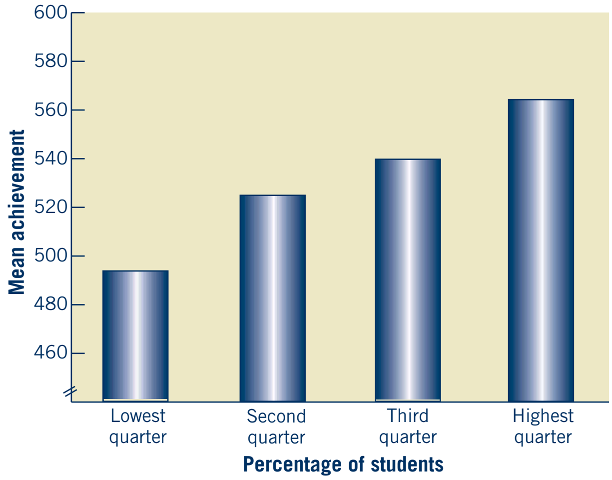


Figure 6.14 Reading Achievement and Control Strategies[7]

Control expectations

The statements relating to control expectations are presented in Table 6.18, which shows the variation in students' responses about how often they use these methods. At least 65 per cent of students believed they could learn something well if they wanted to or they could usually decide not to get bad marks. About half the students believed they could usually learn something that was very difficult or could often or almost always answer a problem correctly if they put their mind to the task.

Table 6.18 Percentages of Students Responding to Statements Relating to Control Expectations

Statement	Almost never	Sometimes	Often	Almost always
When I sit myself down to learn something really difficult, I can learn it.	6	39	39	16
If I decide not to get bad marks, I can really do it.	5	30	38	27
If I decide not to get any problems wrong, I can really do it.	10	43	35	12
If I want to learn something well, I can.	3	27	43	27

Self-efficacy

The statements in Table 6.19 relate to a student's perceived self-efficacy. Students who were more self-assured about accomplishing various tasks, such as those mentioned below, were more likely to perform better than students with less positive beliefs in their own capabilities.

[7] These data were obtained from the PISA international report (OECD, 2001).

Table 6.19 Percentages of Students Responding to Statements Relating to Self-Efficacy

Statement	Almost never	Sometimes	Often	Almost always
I'm certain I can understand the most difficult material presented in texts.	7	48	36	9
I'm confident I can do an excellent job on assignments and tests.	4	32	45	19
I'm certain I can master the skills being taught.	4	35	45	16

Competitive learning

The competitive learning scale consisted of four statements, as listed in Table 6.20. A large majority of students (87 per cent) agreed that they would like to be the best at something. Seventy per cent agreed that they would like to try to be better than other students, and 62 per cent indicated that trying to be better than other students made them work well.

Table 6.20 Percentages of Students Responding to Statements Relating to Competitive Learning

Statement	Strongly disagree	Disagree	Agree	Strongly agree
I like to try to be better than other students.	4	26	53	17
Trying to be better than others makes me work well.	6	32	49	13
I would like to be the best at something.	2	11	47	40
I learn faster if I'm trying to do better than the others.	6	37	43	14

There was a positive relationship between reading achievement and competitive learning, as illustrated in Figure 6.15.

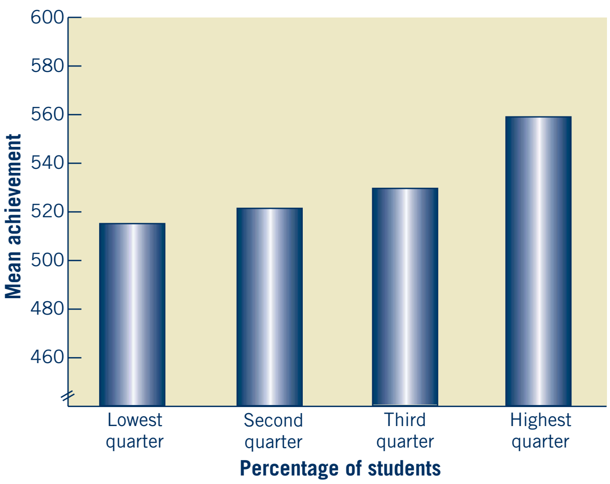


Figure 6.15 Reading Achievement and Competitive Learning[8]

[8] These data were obtained from the PISA international report (OECD, 2001).

Effort and perseverance

The statements relating to students' perceived effort and perseverance are provided in Table 6.21, showing that over half the students said they often or almost always endeavoured to persevere and make an effort when studying.

Table 6.21 Percentages of Students Responding to Statements Relating to Effort and Perseverance

When studying …	Almost never	Sometimes	Often	Almost always
… I work as hard as possible.	5	33	40	22
… I keep working even if the material is difficult.	8	38	40	14
… I try to do my best to acquire the knowledge and skills taught.	4	33	46	17
… I put in my best effort.	5	33	40	22

An example of the relationship between reading achievement and effort and perseverance is shown in Figure 6.16.

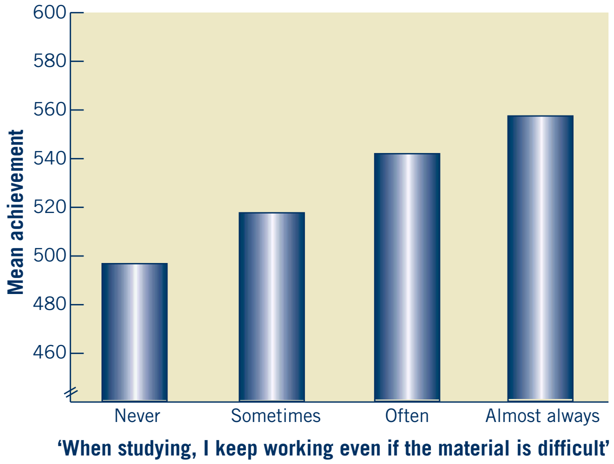


Figure 6.16 Reading Achievement and Persevering when Material is Difficult

A further perspective on student effort was provided in relation to PISA through the inclusion of an 'effort thermometer' at the back of the assessment booklets. Students were asked, on a scale of 1 to 10 alongside a drawing of a thermometer, to indicate how much effort they put into doing the PISA items. They were then asked how much effort they would have invested if the results from the assessment were going to be counted in their school marks.

Not surprisingly, there was a significant difference in the means of these two scales. Mean effort for the PISA assessment was 7.9, while for school marks it was 9.5. Probably also not surprisingly, there was a significant difference between males and females in the effort they claimed to have put into doing the PISA test, with females scoring higher on the scale. Perhaps of more interest is that students in South Australia scored significantly higher than students in all other states except Tasmania in their self-ratings of effort put into PISA.

The correlation with reading literacy achievement of the PISA effort scale (r = 0.17) was at the same level as the correlation for the general effort and perseverance with schoolwork scale. The effort rating assigned to the hypothetical scenario of PISA results contributing to school marks was correlated at a slightly higher level (r = 0.21) with reading literacy achievement.

Summary

This chapter provides a picture of the Australian schools and students who participated in PISA 2000. Several characteristics of the students' home background are described, including students' and parents' countries of birth, language spoken at home, parents' education and family size.

Variables relating to students' reading habits and attitudes towards reading, students' use of and attitudes towards technology and students' assessment of their own self-regulated learning strategies are discussed. Many of these variables were found to be individually correlated with reading literacy achievement in Australia, at significant but typically weak to moderately weak levels. The relationships with achievement of several of the variables are illustrated in a series of graphs. The highest correlation between a variable discussed in this chapter and reading achievement was 0.42, for the *engagement in reading* scale.

Variables relating to school conditions and practices are also discussed in the chapter. These include classroom practices, teacher morale, quality of educational resources, classroom disciplinary climate, pressure on students to achieve and teacher supportiveness. Correlations of these variables with reading achievement were lower than the correlations for the student variables.

Chapter **SEVEN**

SOCIOECONOMIC FACTORS IN THE EDUCATION OF AUSTRALIAN STUDENTS

There are many factors that have an influence on the level of achievement of a student in an assessment such as PISA. These factors can include the background from which the student comes, the school the student attends and the quality of the teaching strategies employed. Some of these variables, as they pertain to the Australian PISA schools and students, have been discussed in the previous chapter. This chapter examines the relationship between the background of the students and their knowledge and skills as measured in the PISA assessments.

The relationship between the socioeconomic background of the students and their achievement scores can be calculated and presented graphically, which is the approach taken in this chapter.

>> *Socioeconomic gradients*

All students who undertook the PISA assessment also completed a questionnaire which included a number of items eliciting information about their background. These items included questions about parents' occupations. This information was coded and recorded as a variable in the data base and was used as an indicator of socioeconomic status (SES) for the production of the graphs in this chapter. The coding of occupations was done in accordance with The International Standard Classification of Occupations (ISCO) developed by the International Labour Organisation.

The terms 'socioeconomic gradient' or 'social gradient'[1] are used to refer to the relationship between a social outcome and socioeconomic status for the individuals of a specific community.[2] The 'social outcome' can include any measurable trait, but in PISA is the students' achievement measured in the three domains – reading literacy, mathematical literacy and scientific literacy.

[1] In sociological research the word 'gradient' can refer generally to a line representing a relationship between two variables – it is not necessarily linear. This contrasts to the use of the word 'gradient' in mathematics where it refers specifically to the steepness of a slope of a straight line.

[2] The measure of socioeconomic status used was calculated from student responses about their parents' occupations. The index used here is the higher of the mother's and father's socioeconomic index (this variable is named HISEI in the PISA database).

Analysis of the data from PISA shows that there is a significant relationship between the results from the student assessments and the students' SES. Moreover, this relationship can be expressed in a line graph which summarises the relationship. The resulting line was found to be almost linear and demonstrates that students with lower levels of SES are more likely to have lower achievement levels.

The social gradient gives information in three main ways:

- The *level* of the graph gives an indication of how well the overall population has achieved on the given assessment. Gradients at higher levels indicate higher mean achievement by the students. Education systems are typically aiming for a relatively high level.
- The *slope* of the graph is an indication of how strongly students' results are associated with SES. A steeper slope indicates a greater difference in achievement between low SES students and high SES students. Education systems typically aim to decrease the differences in achievement between the different social groups. Greater equity would thus be indicated by a flatter gradient – that is, there would be a smaller difference in achievement between students with a high SES and those with a low SES.
- The *range* of SES is indicated on the graphs in this chapter, which are plotted between the 5th percentile of SES and the 95th percentile of SES. A smaller range indicates less difference in SES between the highest and lowest SES levels of the sample.[3] The range can be measured by projecting the starting point and finishing point of the gradient onto the horizontal axis.

The vertical axis in Figure 7.1 represents scores on the total reading literacy scale, which has a mean of 500 and a standard deviation of 100 for all OECD countries combined. The horizontal regions on the graph represent the five proficiency levels that have been defined for the reading scales for PISA 2000, which were discussed in Chapter 3. The horizontal axis represents the index of socioeconomic status, which has a range of 0 to 90 and a mean of 49 for all OECD countries combined. Generally, with regard to social gradients, education systems are aiming to produce a slope which is high and flat – that is, a high level of achievement spread equitably across all levels of SES.

Reading Literacy

Figure 7.1 shows the Australian social gradient for reading literacy plotted with the international gradient of the OECD countries that took part in the assessment (including Australia). It can be seen that the slope of the gradient for Australia follows the general pattern for the international population as a whole – students with lower SES scored less well in the assessment. The level of the Australian graph is higher than the level of the international gradient. Australia's mean on the total reading literacy measure was 528, compared to the international mean of 500. It can also be seen that the range of SES in Australia is slightly less than that of the international sample. The five lighter coloured points lying on the social gradient curves are the 5th, 25th, 50th, 75th and 95th percentiles of SES.

Australian students performed on average above students from the OECD at all levels of socioeconomic status.

[3] The gradients shown are regression lines, which can be thought of as averages of the results from all the students in each of the samples.

Care should be taken in interpreting the association between achievement and SES, especially when it is expressed as a single line as in Figure 7.1. The line represents an average indication of the association between achievement and SES. If all students were situated on the line, it would mean that reading achievement could be predicted accurately simply by knowing a student's SES. This, however, is not the case, as there is a diverse range of scores that students achieve which are not on the line. To illustrate the range of results that was obtained, 2000 students were randomly chosen from the Australian sample and their results plotted as points on the graph. Each point represents one student. It can be seen that the range of results is vast, with a large number of low SES students achieving very high scores and, conversely, students with a high SES achieving very low scores.[4] The resilience of students to a risk factor such as low SES will be of interest to educational policy makers. An examination of the characteristics of such students (that is, with high scores and low SES) is provided in Chapter 9.

Individual students' reading results cover a very wide range and are sometimes not associated with the students' SES.

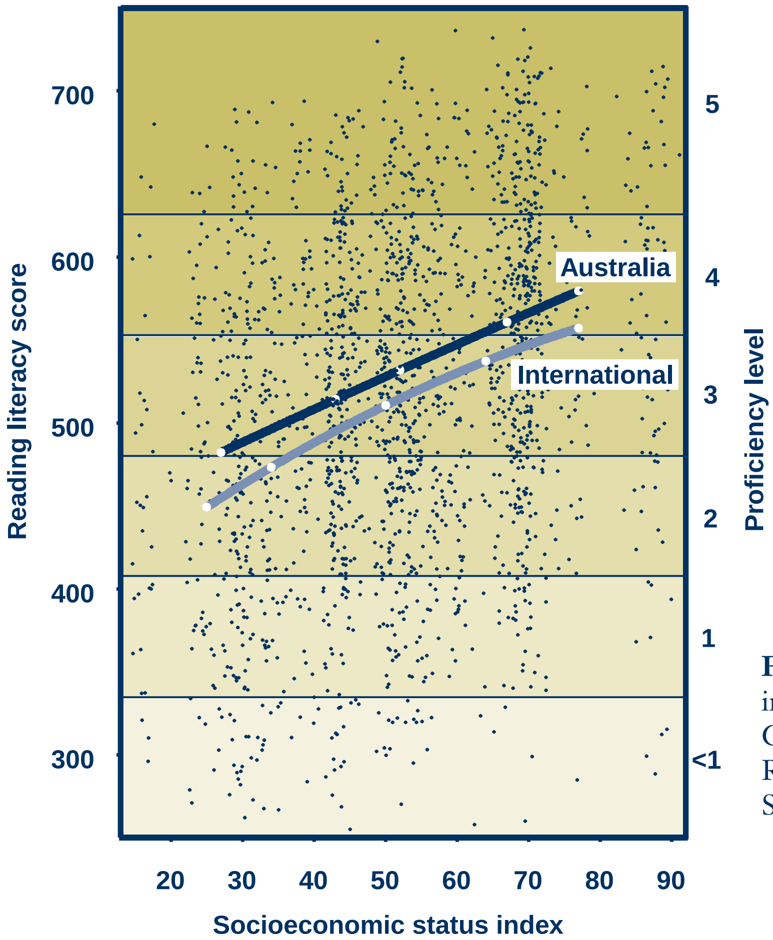


Figure 7.1 Australia's Results in Total Reading Literacy Compared to the International Results and Plotted Against Socioeconomic Status

Care should also be taken in interpreting an increased slope of the graph as indicating a general inequality in a society. Socioeconomic gradients refer to the relationship between an outcome and some measure of socioeconomic status, whereas inequality refers generally to the extent to which wealth or income are distributed across members of a society. Although countries with relatively steep gradients may tend to have greater income inequality, and those with shallow gradients may have

[4] The gathering of the student dots in 'bands' is a result of the way the SES is calculated.

relatively less income inequality, this is not necessarily the case. The steepness is an indicator of how well students of different SES do in a particular assessment.

The analysis of gradients is a means of characterising student performance and providing guidance for educational policy. Socioeconomic gradients can be used to compare results across the countries and to provide an opportunity to examine changes in gradients that occur from one cycle of PISA to future cycles. Similarly, comparisons of socioeconomic gradients can be made between the Australian states' results.

Figure 7.2 shows the gradients for a subset of PISA countries (it is not useful to put more gradients on the graph because it becomes difficult to identify individual countries). Gradients for the Australian states are shown later in the chapter.

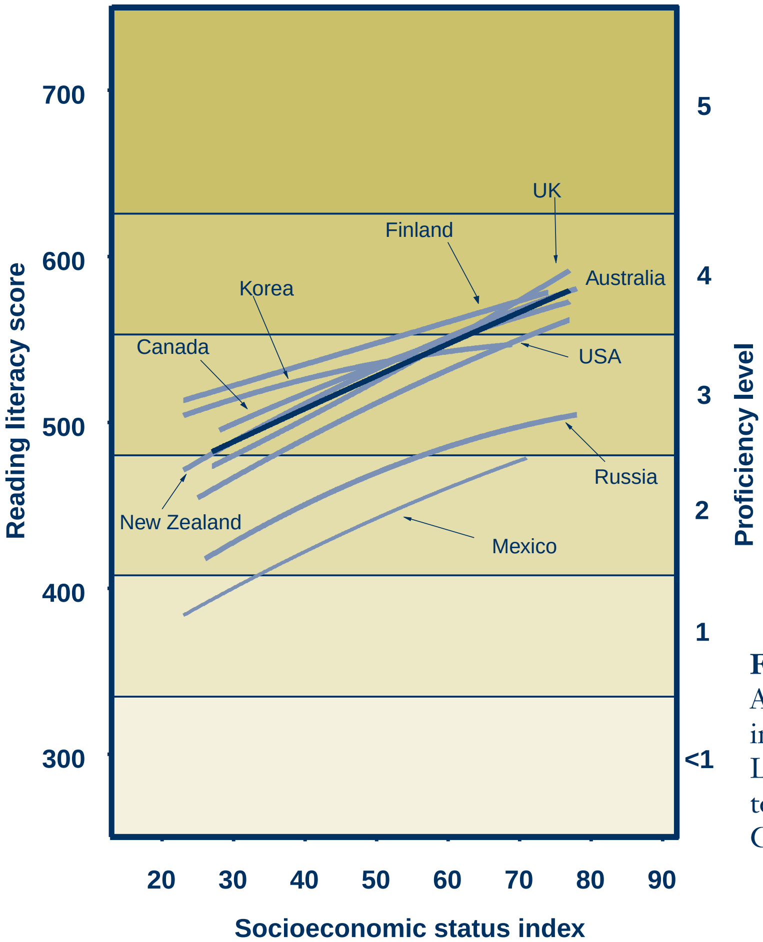


Figure 7.2
Australia's Results in Reading Literacy Compared to Some Other Countries

Australia's results can be compared to other countries' results as shown in the figure. In this figure Australia's results are shown as a thick black line, while the gradients for Canada, Finland, Korea, Mexico, New Zealand, Russia, the United Kingdom and the USA are shown as lighter blue lines. These countries were chosen to exemplify not only a sample of English speaking countries, but also one of our major trading partners (Korea),[5] an example of a country with a relatively flat graph (Finland) and the two other countries from the forum for Asia Pacific Economic Cooperation (APEC) that took part in PISA, Mexico and the Russian Federation.

[5] Japan, another major trading partner and member of APEC, was not included because it was believed that a significant amount of missing data, combined with the particular measure of SES, made valid comparisons difficult.

The inclusion of these countries allows a comparison across the full range of results. It can be seen that the general level of Australia's gradient is similar to that of New Zealand, the United Kingdom and Canada; slightly lower than that of Finland and Korea; and higher than those of the United States, the Russian Federation and Mexico. Australia has a slightly steeper slope than Canada, although not as steep as the United Kingdom. Each of the countries, except Mexico and Finland, has a similar upper range for the SES scale (the 95th percentile defines the upper limit of the SES range that was plotted), but New Zealand, Finland, Korea, the United States and Mexico have a lower starting point for SES (the 5th percentile) – that is, these countries have a greater proportion of students with a lower SES than the other countries. The gradient for Korea curves slightly so that it is nearly horizontal at high values of SES. This means that high SES students are not experiencing the same increase in reading score for a unit rise in SES as students are in the other countries shown here.

The slope for Finland is among the shallowest for all the countries that participated in PISA 2000. This may be a result of the fact that schools in Finland are very uniform in their resources and organisation throughout the country. There is further discussion of this in Chapter 8.

Another feature that this graph demonstrates is that there is less difference, generally, between the countries at high levels of SES than there is at low levels – the slopes appear to converge slightly at high SES. This is also observed when the social gradients of all countries are plotted together, implying that students with high levels of socioeconomic status tend to vary less in their reading performance, from country to country, than students with relatively low levels of socioeconomic status. This convergence indicates that the impact of educational experiences on student performance is probably greatest for students from lower socioeconomic backgrounds.

PISA results imply that the impact of education on performance is greatest for students from disadvantaged backgrounds.

>> *A comparison of the three reading sub-scales*

In PISA 2000 the major domain was reading literacy. As we saw in Chapter 3, the reading domain was divided into three sub-scales – retrieving information, interpreting texts and reflecting on and evaluating written material. Figure 7.3 shows the comparison of Australian results on these three sub-scales when plotted against SES.

The figure shows that the Australian students who took part in PISA 2000 were more proficient in retrieving information than in interpreting it or reflecting on its implications. Although the gradient for retrieval of information is at a higher level than the other two, it can also be seen that the slopes of the three reading sub-scales are the same. This implies that a unit increase in SES is associated with a similar increase in achievement in each of the three reading sub-scales.

As before, horizontal shading on the graph represents the five proficiency levels that have been defined for the reading literacy scales for PISA 2000, which were discussed in Chapter 3.

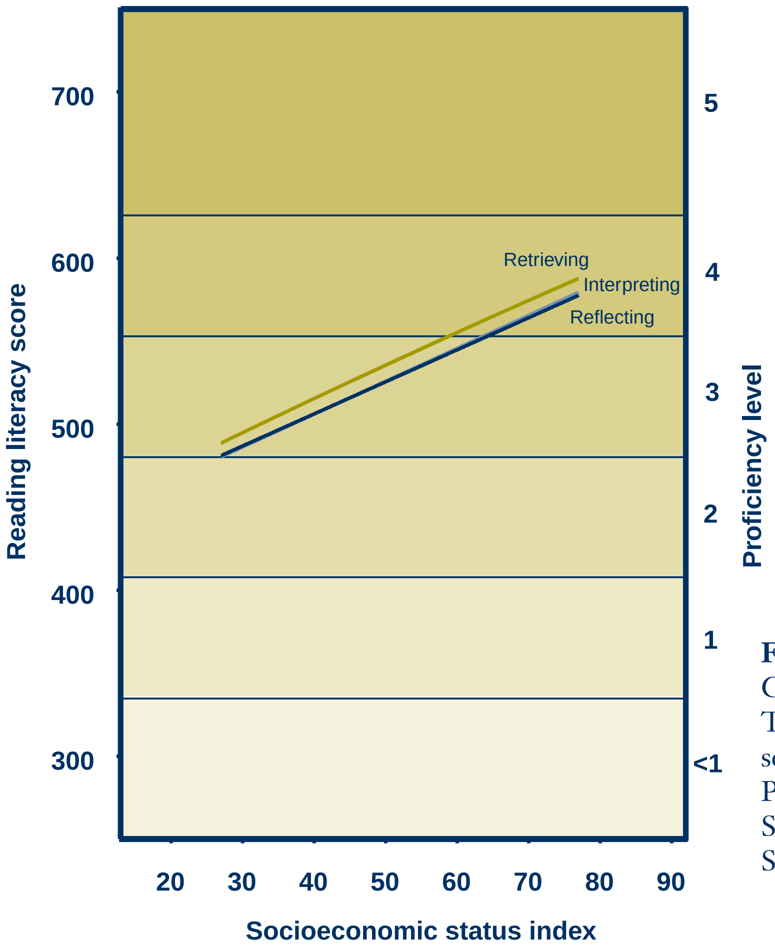


Figure 7.3 A Comparison of the Three Reading Sub-scales in Australia Plotted Against Socioeconomic Status

Mathematical literacy

In the PISA 2000 assessment, the major domain was reading literacy and the minor domains were mathematical literacy and scientific literacy. Figure 7.4 shows the SES gradients for Australian students in mathematical literacy compared to the international gradient for that domain. The vertical axis shows the mathematical literacy score for the students, while the horizontal axis shows the SES. It can be seen that Australia's gradient is at a higher level than that of the international gradient and is more linear.

As there were no proficiency levels defined for mathematical literacy in PISA 2000 (see Chapter 4), the shading on the graph is simply based on measures above and below the international mean of 500.

In a similar manner to the graph for reading, a random sample of 2000 Australian students was chosen and their results placed on the graph. This gives an indication of the diverse range of scores that was obtained for mathematical literacy in Australia. Again, the resilience of students with a lower socioeconomic status who achieve a high score is of interest (see Chapter 9).

In Figure 7.5 Australia's results for mathematical literacy are plotted against the same selection of countries as for reading literacy. It can be seen that, in this sample, Korea is the country with the highest, flattest social gradient – Korea was one of the highest scoring countries in both mathematical and scientific literacy.

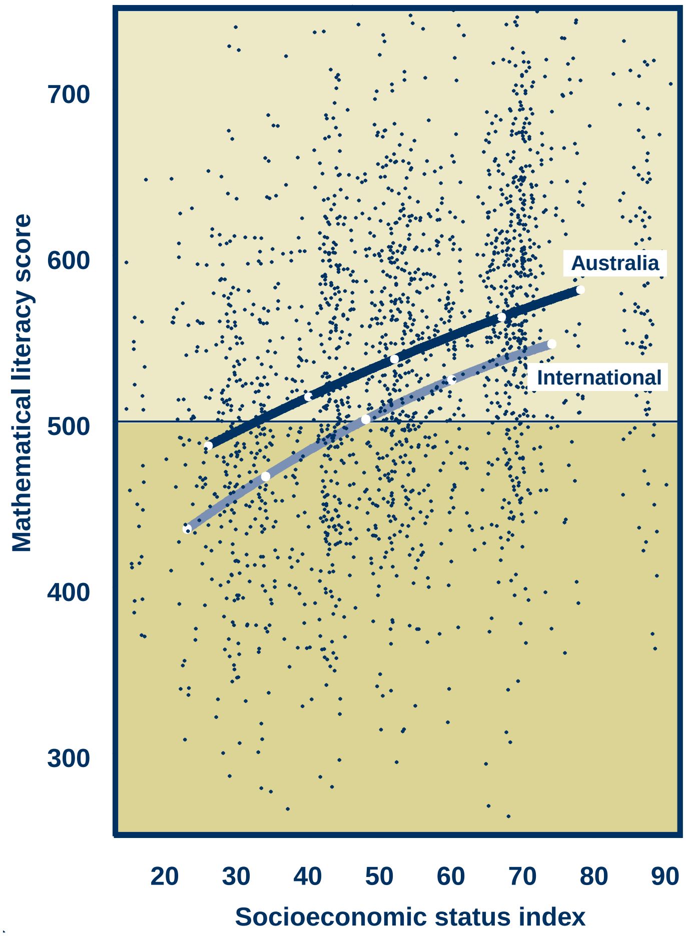


Figure 7.4
Australia's Results in Mathematical Literacy Compared to the International Mean and Plotted Against Socioeconomic Status

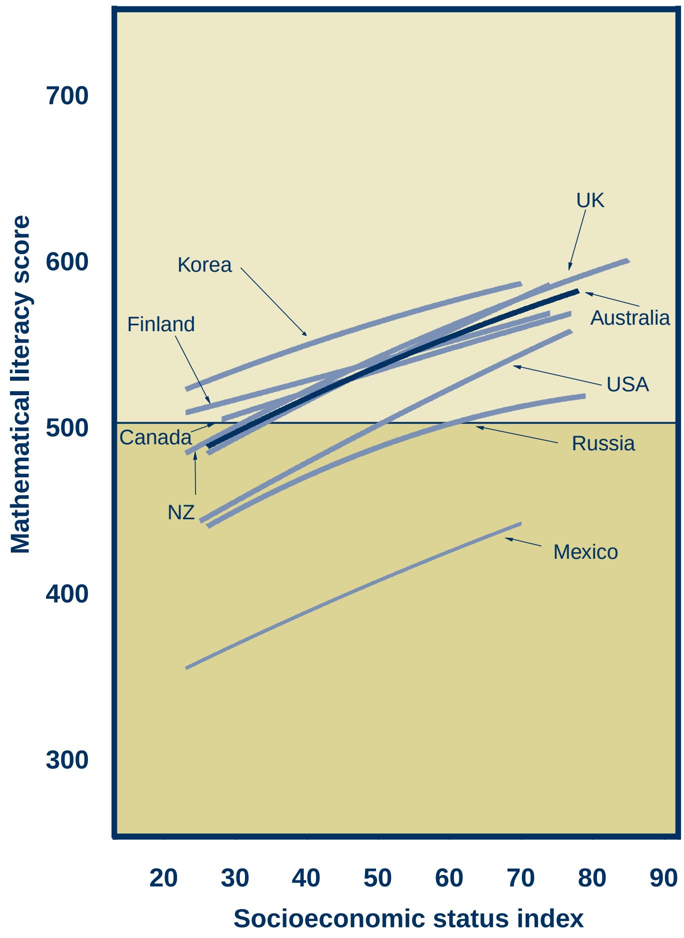


Figure 7.5
Australia's Results in Mathematical Literacy Compared to Some Other Countries

It is interesting to compare the relative positions of Korea's gradients for mathematical literacy and for reading literacy – their gradient for mathematical literacy is at a relatively higher level than it is for reading. Korea, Finland, Canada and the Russian Federation have slopes slightly flatter than Australia.

The results for the Russian Federation are at a relatively higher level for mathematical literacy than for either reading literacy or scientific literacy.

Scientific literacy

Figure 7.6 shows the socioeconomic gradient for Australian students in scientific literacy compared to the international gradient for that domain. The vertical axis shows the scientific literacy score for the students, while the horizontal axis shows the SES. It can be seen that Australia's gradient has a higher level than that of the international gradient. Both gradients are slightly curved, but in opposite directions. Australian students who have either a very low or a very high socioeconomic status achieve higher scientific literacy scores than their international counterparts.

There were no proficiency levels defined for scientific literacy in PISA 2000, and so, as for mathematical literacy, the shading on the graph is simply an indication of regions above and below the international mean of 500.

In a similar manner to the graphs for reading and mathematical literacy, a random sample of 2000 Australian students was chosen and their results placed on the graph. This gives an indication of the diverse range of scores students obtained for scientific literacy.

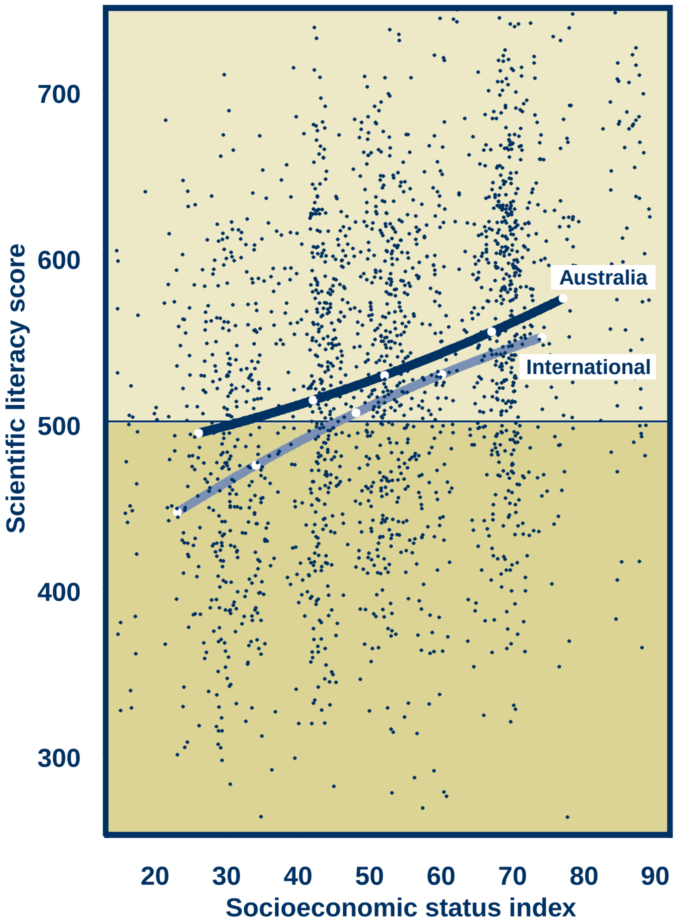


Figure 7.6
Australia's Results in Scientific Literacy Compared to the International Mean and Plotted Against Socioeconomic Status

Australia's social gradient is plotted against the same sample of countries as for reading and mathematical literacy in Figure 7.7. It can be seen that Australia is in much the same relative position for scientific literacy as it is for the other domains. Korea's gradient is at the highest level and is flatter than the social gradients of the other countries.

The figure also shows that the gradient for the United Kingdom is steeper than the other countries for scientific literacy as it was for reading and mathematical literacy.

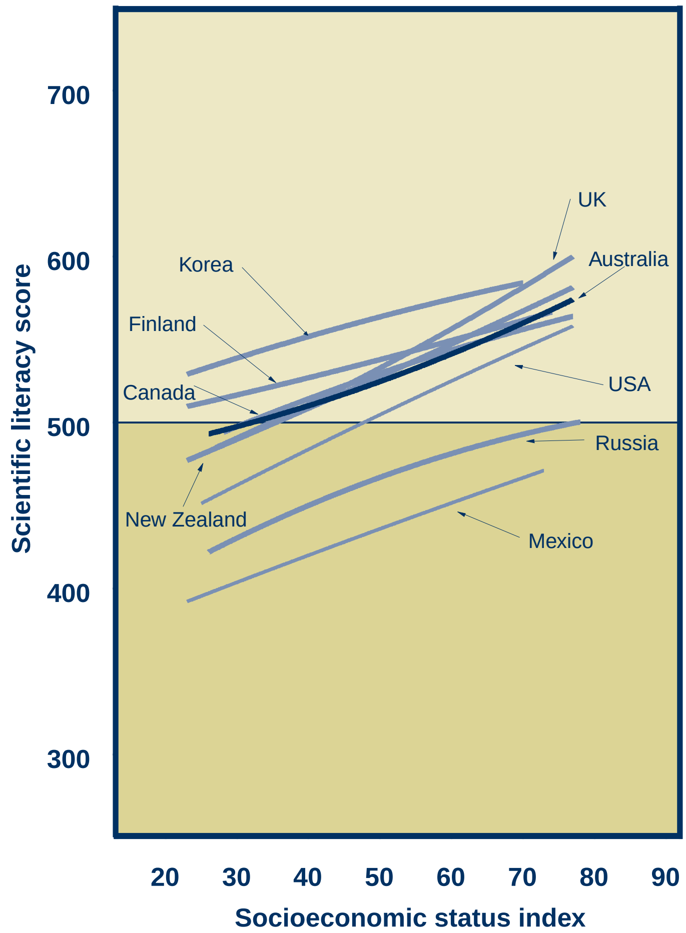


Figure 7.7 Australia's Results in Scientific Literacy Compared to Some Other Countries

A comparison of reading, mathematical and scientific literacy

A comparison of the social gradients for reading, mathematical and scientific literacy gives an indication of which one of these domains is more dependent on the home background of the student – a steeper slope can indicate that the home background is having more influence than if the slope is shallower. A shallower slope probably indicates that the schools are able to decrease the effect of home background. A subject that has a shallower slope, then, may be more school dependent than a subject with a steeper slope. Figure 7.8 shows the gradients for reading, mathematical and scientific literacy for Australia. Reading has a steeper slope than the other two, suggesting that, for a given difference in SES, the reading

In Australia, reading skills depend more on home background than skills in mathematics or science do.

score will increase more than the scores on the other two domains. Another way to interpret this is that success in reading literacy depends more on the home background than success in mathematical or scientific literacy.

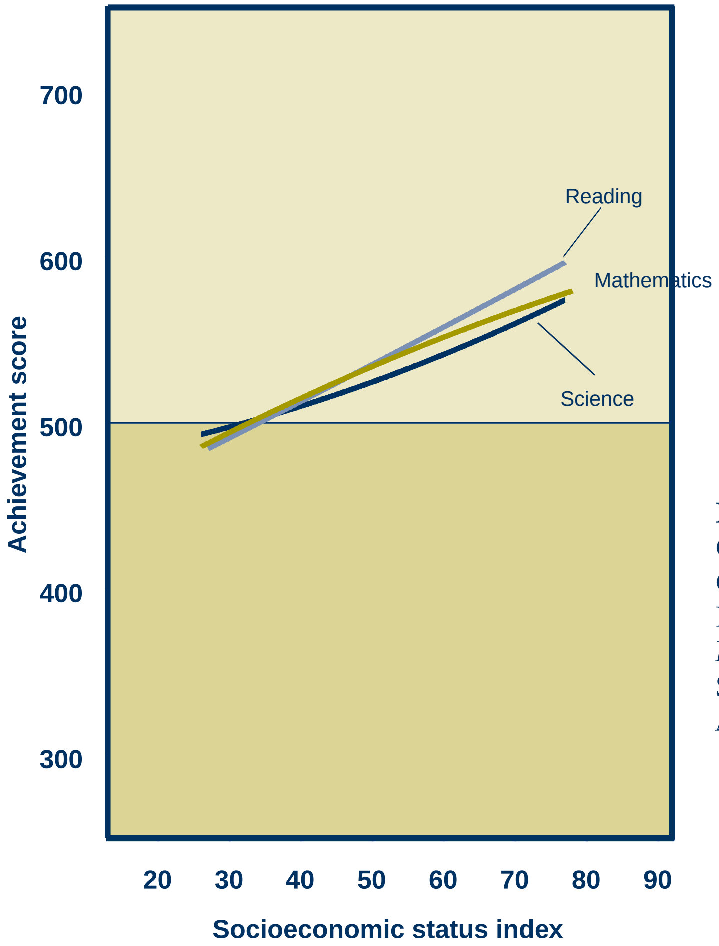


Figure 7.8 A Comparison of Social Gradients for Reading, Mathematical and Scientific Literacy in Australia

There is some variation in the patterns for reading, mathematical literacy and scientific literacy across the countries. In Korea, for example, the mathematical literacy and the scientific literacy scores are higher than the reading literacy scores (Figure 7.9), whereas in Finland the opposite is the case. In Finland the reading literacy scores are higher than the mathematical literacy or the scientific literacy scores (Figure 7.10). In Canada (Figure 7.11), the pattern is very similar to that in Australia. This may suggest something about the emphasis on these subjects in those countries, or the relative ability of the curricula to prepare students for the future in these domains.

In Korea, the pattern was different than in other countries.

The graphs for these countries also show that mathematical literacy and scientific literacy tend to be more closely related to each other than reading literacy is to either of them.

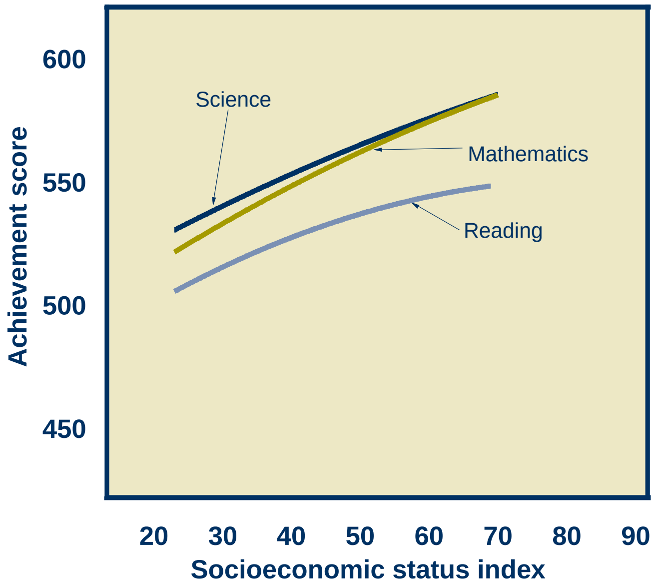


Figure 7.9 A Comparison of Social Gradients for Reading, Mathematical and Scientific Literacy in Korea

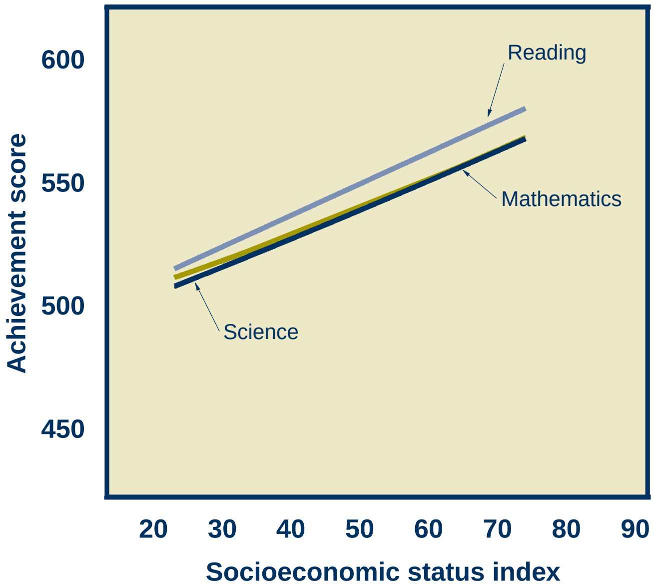


Figure 7.10 A Comparison of Social Gradients for Reading, Mathematical and Scientific Literacy in Finland

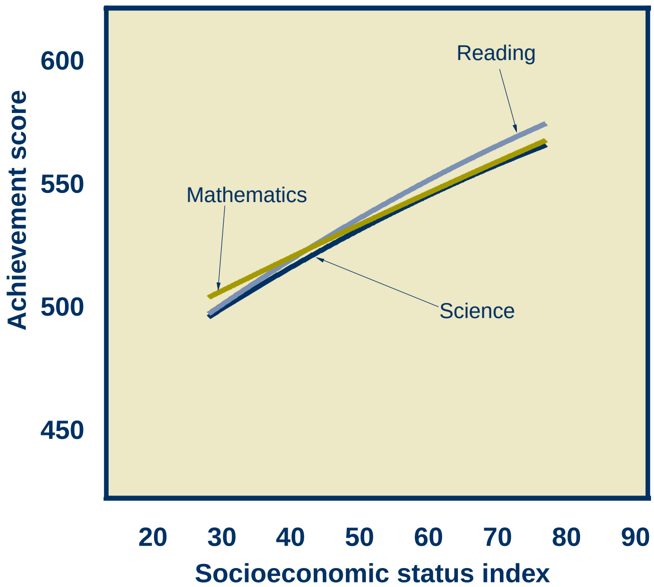


Figure 7.11 A Comparison of Social Gradients for Reading, Mathematical and Scientific Literacy in Canada

A comparison of the social gradients for the Australian states

The means of the results of the Australian states are considered in some detail in Chapter 5 of this report. The results of the states are further explored in Figure 7.12, which shows the social gradient of each of the states for reading. The information given can be used to compare the range, level and slope of the results. The figure shows that the range of SES was greatest in NSW and narrowest in Victoria.

The means of the states have been discussed in a previous chapter and are reflected in the differing levels of the various lines. It is informative to compare the reading achievement of students of the same SES in the different states. This can be done if a vertical line is drawn through the social gradients at the overall Australian mean SES of 52. By looking at the values of the reading scores for each of the states on this line, a slightly different view emerges. The results from South Australia, the Australian Capital Territory, New South Wales and Western Australia tend to form a cluster at the top of the SES line, followed by Tasmania, Queensland, Victoria and the Northern Territory. In other words, students with an average SES in South Australia, the Australian Capital Territory, New South Wales and Western Australia score higher than their counterparts in Tasmania, Queensland, Victoria and the Northern Territory.

Tests for significant differences were done on the total reading results with the states grouped as indicated in Figure 7.12. The reading mean for the first group of four states listed above was significantly higher than the mean for a group comprising Tasmania, Queensland and Victoria, which in turn was significantly higher than the mean for the Northern Territory. Initially Victoria's result was examined separately from Tasmania's and Queensland's, but it was not significantly different. These analyses clearly show that the mean achievement results for students of average SES varies from state to state.

There were significant differences in reading literacy results for students of average SES between groups of Australian states.

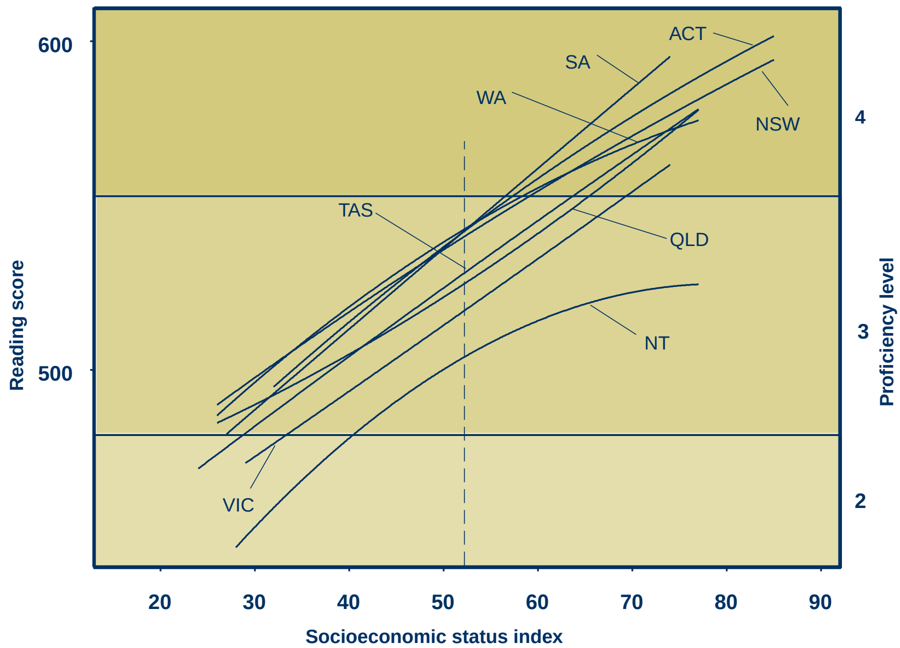


Figure 7.12 A Comparison of the Reading Literacy Social Gradients of the Australian States

The shape of the lines tends to be linear with the exceptions being Western Australia, Queensland and, more notably, the Northern Territory. A linear slope indicates that a unit increase in SES is associated with the same increase in reading score across the whole range of SES. Figure 7.13 isolates those three states. The shape of the Queensland curve tends to be flatter at lower SES than it is at higher SES, while the opposite is true for Western Australia and the Northern Territory. This implies that in Queensland a unit increase in SES at the lower level is associated with a smaller increase in reading score than is an equal increase in SES at the higher level.

In Western Australia and Northern Territory, a unit increase in SES at the lower level is associated with a larger increase in reading score than is an equal increase in SES at the higher level. The slope for the Northern Territory is almost horizontal at one point in the high SES range, indicating no change in reading score for an increase in SES – the students with very high SES in the Northern Territory are not achieving the same increase in results as their counterparts in the other states.

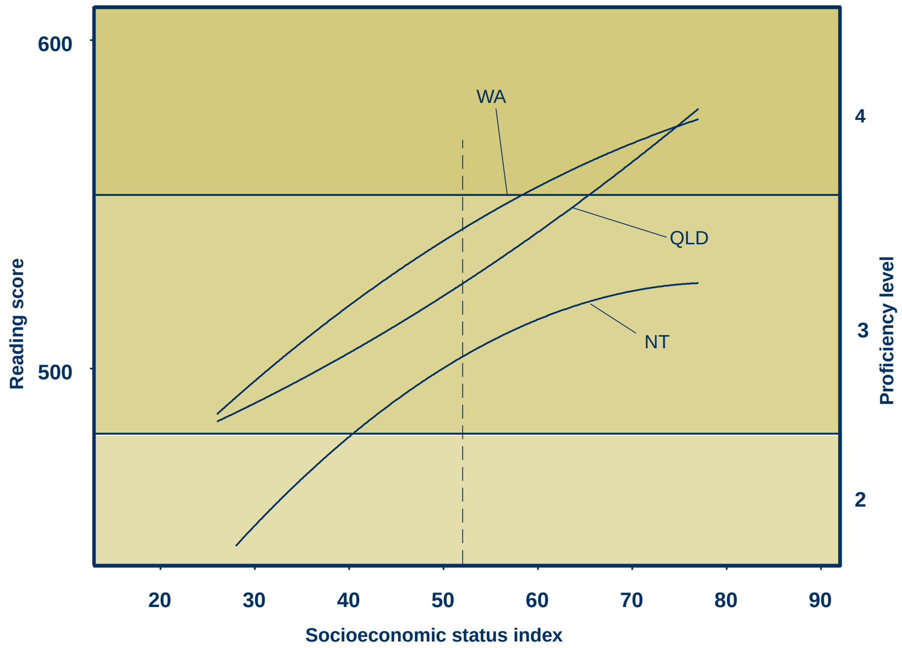


Figure 7.13 A Comparison of the Reading Literacy Social Gradients of Queensland, Western Australia and the Northern Territory

The probability of achieving a low reading score

From the previous sections, it has been shown that a student's socioeconomic background is associated with the level of reading literacy achieved, as measured in PISA 2000.

A further illustration of this association can be provided by examining, in more detail, the results of students from different socioeconomic backgrounds. Table 7.1 displays the numbers of students with low SES who achieved a low reading score and compares this to students who are not from a low SES background. 'Low SES' and 'low reading score' are both defined as being within the lowest 25% of results for the

Australian students. The table shows that the percentage of students in the low SES group who obtained a low reading score was 38.8%, whereas the percentage of students not in the low SES group with a low reading score was 19.7%. A comparison of these two percentages shows that the probability of being in the low reading group is much higher with a low SES – in fact nearly twice as likely (38.8/19.7 = 1.97).

Australian students in the lowest quarter of SES were twice as likely as students not in that quarter to achieve low scores in reading.

Table 7.1 A Consideration of the Number of Low SES Students Who Have a Low Reading Literacy Score in Australia

	Number of students with a low reading score	Number of students not with a low reading score	Total
Students in low SES group	377	594	971
%	38.8%	61.2%	100.0%
Students not in low SES group	788	3203	3991
%	19.7%	80.3%	100.0%
Total	1165	3797	4962[6]
%	23.5%	76.5%	100.0%

The probability of a student who has a low SES achieving a low reading score can also be illustrated graphically. This probability can be expressed across the whole range of SES. In Figure 7.14 the vertical axis is the probability of a student being in the lowest 25% of the reading scores for Australia. The horizontal axis is the range of SES scores. The graph shows separate results for males and females.[7]

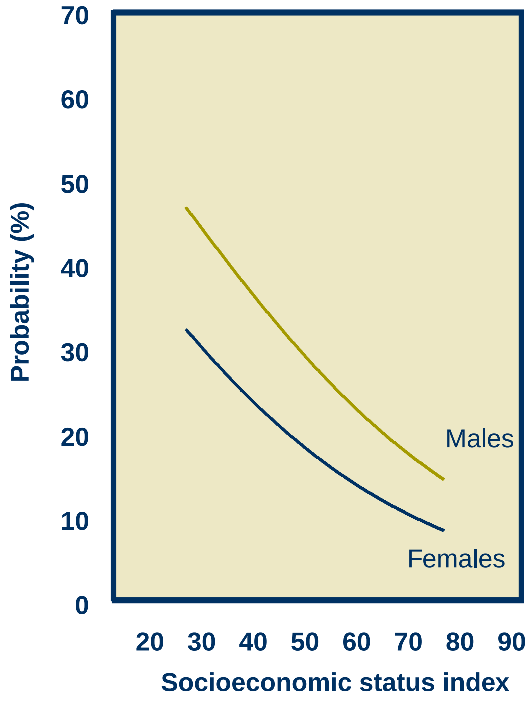


Figure 7.14 Probability of Males and Females Achieving a Low Score in Reading Literacy in Australia

The slope shows that there is a striking decrease in the probability of being in the low scoring reading group as the SES increases. The graph shows two trends. Firstly, it provides a further illustration of the association of SES with reading achievement

6 This number is slightly different from other totals listed for the size of the Australian sample because of missing data.
7 This calculation is based on a logistic regression, using the 25th percentile as the upper boundary to indicate a low reading score.

scores generally, and secondly it illustrates the gender differences in reading in PISA 2000. At the lower end of the SES scale, males have a 49% chance of being in the low reading group (that is, in the lowest 25% of the reading scores). This compares to females at the lower end of the SES scale who have a 31% chance of being in the low reading group.

Males were more likely than females to achieve low reading scores.

At the high end of the SES scale the graph shows that both males and females are less likely to be in the low reading group. There is also a slight decrease in the difference between males and females with high SES.

The probabilities of achieving a low score in mathematical and scientific literacy are illustrated in Figures 7.15 and 7.16. Once again a 'low score' is defined as being in the lowest 25%.

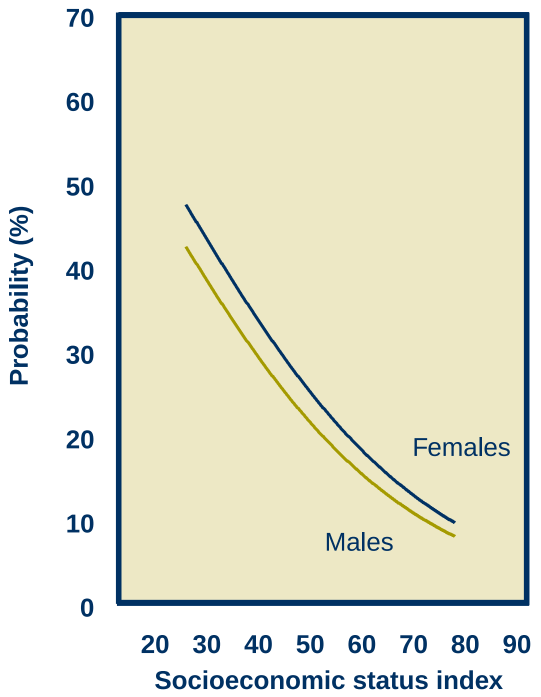


Figure 7.15 Probability of Males and Females Achieving a Low Score in Mathematical Literacy in Australia

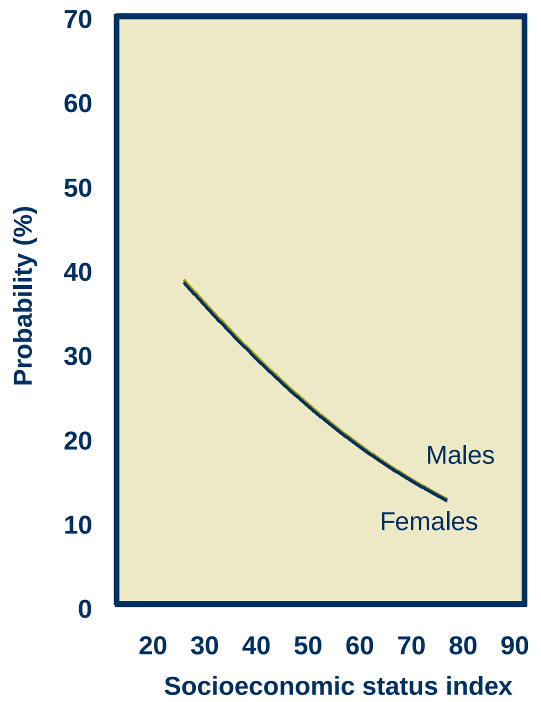


Figure 7.16 Probability of Males and Females Achieving a Low Score in Scientific Literacy in Australia

There are some interesting differences between the graphs for reading literacy, mathematical literacy and scientific literacy. It can be seen that, for mathematical literacy, the probability of being in the low scoring group is higher for females than it is for males, although the two lines are closer together in mathematical literacy than they are in reading literacy. There is also a slight decrease in the difference between males and females in the higher SES part of the graph.

The probability of males and females achieving a low score in scientific literacy is shown in Figure 7.16, where it can be seen that a student's probability of being in the low scoring group is higher if they come from a family with a low SES. The obvious difference with scientific literacy compared to reading and mathematical literacy is that males and females have almost the same probability curves. This is in keeping with other observations about scientific literacy in PISA in Australia, where no significant difference was observed in the means for males and females.

>> *Summary*

This chapter has presented Australia's results from PISA 2000 in the context of a consideration of the students' socioeconomic background. This was done in the form of socioeconomic gradients – that is, plotting of students' achievement scores against their socioeconomic status. The measure of socioeconomic status used was the PISA variable HISEI, which is based on parents' occupations.

The gradients showed that Australia's results follow the general trend of the international results, with a moderately strong association between achievement and socioeconomic status in the three domains of reading, mathematical and scientific literacy. The graphs also showed a diverse range of results for Australian students.

A comparison of the three domains showed that reading literacy had a slightly steeper slope than either mathematical or scientific literacy, indicating that success in reading depended more on home background than the other two domains.

The graphs for the Australian states also generally showed the same degree of association between achievement and socioeconomic status, although some differences were illustrated between the states.

Finally, the chapter considered in more detail the probability of males and females with low socioeconomic status obtaining low scores in the three PISA domains and showed that this probability varied – males were more likely than females to be in the low reading literacy group, whereas females were more likely to obtain a low score for mathematical literacy, and there was no significant difference in scientific literacy.

Chapter **EIGHT**

MULTILEVEL ANALYSIS OF AUSTRALIA'S RESULTS

Students' achievement can be influenced by their backgrounds and the characteristics of the learning environments that they experience. Chapter 7 presented a discussion of the association between socioeconomic status and student achievement in the three domains assessed in PISA. This chapter considers a number of other factors that are associated with student achievement in PISA. The analysis and interpretation is focused mainly on reading literacy, the major domain in PISA 2000. Some of the analyses were also done for mathematical and scientific literacy and are described later in the chapter.

>> *Multilevel analysis*

The sample for PISA 2000 was chosen in a two step process. First, the schools were chosen randomly from the population of schools and secondly, the students were chosen randomly from within those schools. Students' achievement levels could be affected not only by their own ability and background, but also by the nature of the school itself. A multilevel analysis considers how the students' achievement is associated with their own background and also how it is associated with school factors. The multilevel analysis undertaken for this chapter examined factors at these two levels.[1] Level 1 variables are most directly related to the students themselves and include socioeconomic status and gender, and other factors such as the level of parents' education, the wealth of the student's family, the number of siblings that the student has, the family structure and the immigrant status of the student and family. Level 2 analysis of the data examines those variables that are related to the characteristics of the school, such as the mean socioeconomic status of the school, the size of the school and aspects of school climate (for example, perceptions of teacher morale or the disciplinary climate).

For a better picture of the relative importance of factors related to achievement, analyses were done that took into account whether factors were measured at school or student level.

[1] It is possible to consider further levels of analysis by considering the next level of grouping, which in Australia could be, for example, at district or state level. This was not within the scope of this report but could be done at a later stage.

One way to consider these factors is to analyse the amount of variance in an outcome variable that each of the variables explains in the context of the total amount of variance that occurs within schools and between schools. In this analysis, the amount of variance explained by each factor is for that factor alone after the effects of the other factors have been taken into account.

>> *Multilevel analysis for reading literacy*

The results from the international study were scaled so that the mean for each of the domains was a score of 500 and the standard deviation was 100. Generally, the variance is the square of the standard deviation, which gives a mean variance of 10 000 for the international sample. This figure is made up of a component of variance that occurs *between* schools and a component of variance that occurs *within* schools – the value itself is related to the dispersion of scores achieved by the students in the reading assessment (that is, to how spread out from the mean the scores are). Table 8.1 shows the breakdown of variance for some countries in reading literacy in PISA. The total amount of variance in a country is the sum of the within school variance and the between school variance. The countries listed in the table have been chosen to give a comparison with some of the results of countries in the previous chapter and to exemplify the large differences observed in variance.

Table 8.1 Percentage of Between School Variance in Reading Literacy Achievement Scores for Different Countries

Country	Between school variance	Within school variance	Between school variance as a percentage of total variance
Australia	1583	7516	17.4
New Zealand	1861	9456	16.4
Canada	1545	7372	17.3
United Kingdom	2063	7446	21.7
USA	3182	7520	29.7
Sweden	763	7609	9.1
Austria	6137	4272	59.0

The relationship of the amount of between school variance to within school variance can be an indicator of the uniformity of schools in a country. Table 8.1 shows that, in Australia, the between school variance amounted to 17.4 per cent of the total variance, whereas in Austria the between school variance amounted to 59 per cent of the total. This difference in the two countries' results can be accounted for, in part, by the structure of their respective education systems. In Austria, students follow different educational tracks and are educated in different types of schools – leading to a higher proportion of between school variance. Students undergo a selection process for a particular educational 'track'. In Australia, although there are different sectors of education, namely government and non-government, the differences between the schools in them is not large, as indicated by the relatively low proportion of the total variance that is due to schools.

Differences between schools in Australia are relatively small compared with differences in many other countries.

In Sweden, by contrast, all the schools are comprehensive and directed by the same authority. The difference between schools is clearly less than in Australia, as reflected in the smaller percentage (9.1) of the total variance being accounted for by between school variance.

The interpretation of these differences can provide a guide for policy makers. In countries where there is a relatively large variation in achievement within schools (for example, Australia), it could be suggested that reforms aimed at improving performance of low achieving students in general will be more likely to be effective than reforms targeted at improving particular schools. On the other hand, in countries where there is a relatively large variation in performance between schools, reforms aimed at improving the performance of the lowest achieving schools will be more likely to be effective in improving overall performance.

The amount of within school and between school variance in reading achievement can be further explored by looking at the impact on achievement of a range of student and school background factors.

In exploring these factors, it should be remembered that PISA was not specifically designed to gain information about the nature of classroom teaching strategies. The PISA sample of 15-year-olds is not based on classes, but is a random sample taken from all the 15-year-old students at each school regardless of their year level. In addition to this, student perceptions cannot be linked to specific teacher data as no teacher questionnaire was used.

The experiences and background that students bring to classrooms and schools contribute to the learning outcomes the students can achieve. Through a process of Hierarchical Linear Modeling (HLM) (Bryk & Raudenbush, 1992), this chapter examines a number of those factors. The HLM process can examine the contribution that each of the factors makes in explaining the variance within schools and between schools.

With HLM, the process involves building up a model to try and identify the factors that are most useful in explaining the variance in an outcome of interest, in this case the reading literacy scores. In building up the model, a comprehensive range of variables is included initially to gauge the relative significance of the variables in contributing to explanation of variance in the outcome measure. The model is then progressively refined so that the most important variables are retained in the final version.

After following this process, the factors which were significant in the analysis of the Australian PISA reading literacy data are listed in Table 8.2, which also shows the amount of variance that each factor accounted for. The model explained a total of 79.8 per cent of the total between school variance and about 26.3 per cent of the within school variance. The majority of the remaining within school variance is likely to be explained by differences in the abilities of the students and many other characteristics that were not identified in PISA.

The next few pages provide details of the variables that were retained in the model after variables that made no contribution to explaining the variance in reading scores were removed. Further explanation of the variables can be found in Appendix 4.

Student background (Level 1) factors

Gender

In recent years there has been a focus on gender equity in educational opportunities. This focus has often been in the form of increased encouragement for males and females to select courses that were previously regarded as non-traditional for their gender – that is, encouraging females to undertake courses in technology, advanced mathematics and physical sciences; and encouraging males into courses in literature and languages other than English. In PISA 2000, the gender of a student made a significant contribution to the explanation of the variance between students in reading literacy. As reported in earlier chapters, females achieved significantly higher scores than males on the combined reading literacy scale and also on the three reading sub-scales.

The results from PISA suggest that there is a problem with the achievement level of males in reading. This is a complex issue, but one possibility is that the nature of the courses provided in our schools, or the assessment of those courses, may be leading to different levels of engagement and, consequently, to different results for males and females. Further investigation is needed to probe the different learning styles of males and females to determine if this is so, and then to design courses and assessments that are appropriate to those styles. Another possibility is the differences in reading material that males and females engage with, and the males' lack of skills in dealing with continuous texts (see Chapters 3 and 6, where some results pertaining to these issues are presented).

Socioeconomic status

The importance of the socioeconomic status (SES) of students in contributing to achievement has been discussed in detail in Chapter 7. This chapter examines this association from further perspectives. Among other variables, Table 8.2 shows that student SES explained 32.6 per cent of between school variance, and 5.1 per cent of within school variance. The socioeconomic status measure in PISA is based on parents' occupations and is measured on a scale ranging from 0 to 90 internationally, and had a mean of 52 in Australia (the range of the scale in Australia was from 16 to 90). The between school variance in Australia, although relatively small, was largely explained by the socioeconomic status of the students.

Variance in achievement between schools in Australia is largely explained by differences in SES at both student and school levels.

The challenge for education systems and schools is to provide experiences for students that help to ameliorate the effects of SES without decreasing the existing high performance of students with high SES – that is, to boost the performance of the lower SES students.

Family wealth

The *family wealth* variable was constructed from student responses to a number of questions about family possessions, such as the number of bathrooms, cars and computers. It explained 8.9 per cent of between school variance and 1 per cent of within school variance (factors other than wealth were more dominant in explaining within school variance). Students coming from homes with higher levels of possessions

Table 8.2 Variance Decomposition For Reading Literacy in Australia

Factor	Percentage of between school variance accounted for	Percentage of within school variance accounted for
Gender	5.8	4.8
Socioeconomic status	32.6	5.1
Family wealth	8.9	1.0
Home educational resources	1.4	1.6
Parents' education	4.2	0.6
Living with another guardian	0.0	0.3
Number of siblings	1.4	0.4
Immigrant status	0.0	1.0
Time spent on homework	6.6	1.4
Enjoyment of reading	1.2	8.6
Comfort with computers	0.0	0.4
Confidence and self-efficacy	0.0	0.7
Student determination to do well	0.0	0.1
Mean school SES*	13.9	0.3
Disciplinary climate*	2.5	0.0
Teacher morale*	0.9	0.0
School size*	0.4	0.0
Total variance accounted for	79.8	26.3

* School level variables, discussed in the next main section

typically have access to a wider variety of stimulus materials and better access to information sources such as the Internet. This factor is different from the socioeconomic status variable used here and in the previous chapter, which was based on parental occupations.

Home educational resources

It would be expected that students with better access to educational materials such as dictionaries, text books and a quiet place to study, would achieve higher scores on the reading assessment in PISA. The impact of this variable was above and beyond the other measures of home background such as socioeconomic status. The presence of such resources in the home was found to explain the relatively low amounts of 1.4 per cent of the between school variance and 1.6 per cent of the within school variance.

Parents' education

The parents' education level was determined from student responses to questions about the level of educational attainment of their mother and father. Their responses were coded using the International Standard Classification of Education (ISCED). This variable was significant and had a positive association with the reading score. It is likely that parents with a higher level of education are not only able to provide assistance and motivation to their offspring, but may have a heightened awareness of the educational opportunities that are available.

Living in a single parent family or in the care of a guardian

In Australia, living in a single parent family was statistically insignificant in relation to achievement. Being in the care of another guardian explained just 0.3 per cent of within school variance and none of the between school variance.

Number of siblings

The number of siblings in the student's family was associated with the reading achievement score, explaining 1.4 per cent of between school variance and 0.4 per cent of within school variance. A larger number of siblings had a slight negative effect on the reading score.

Immigrant status

Australia has had a policy of encouraging immigration since the 1940's and a significant proportion of residents were either born overseas or have parents who were born overseas. Immigrant status is a complex issue and is difficult to define. Some students may be born overseas, but to English speaking parents, so that the language spoken at home is the same as the test language and, therefore, no barrier to success. On the other hand, there are students who were born in Australia, but who may live in a household where English is not spoken. Immigrant status in PISA was determined in a simplistic way according to whether or not a student was born in the country where they were doing the assessment. In Australia, additional data were collected for students and parents about which countries they were born in and which language was spoken at home most of the time. These more detailed data will be explored in a subsequent report. It was found that immigrant status was significantly related to reading literacy scores and accounted for 1.0 per cent of the within school variance. Students born overseas had a slightly lower reading mean than those born in Australia.

Time spent on homework

There are many demands that are placed on students – both within school and outside school. Students, in addition to their school commitments, often work part-time, have sporting commitments, family duties, and importantly, at the age of 15, are undergoing significant biological and social developments. The students, their schools and their parents find themselves with a problem – should students have to complete work at home on school related tasks or not? 'Why can't it all be done at school?', one hears (and, alternatively, from some parents, 'Why doesn't the school give more homework?'). The results from PISA show that there was a significant association between homework and reading score. The amount of variance explained by the homework variable, which relates to the amount of time spent on homework, was 6.6 per cent of between school variance and 1.4 per cent of within school variance. It appears that schools and parents should be encouraging students to do homework as a way of enhancing the students' educational achievement.

A significant association was found between amount of homework done and reading literacy achievement.

Enjoyment of reading

An important factor in the assessment of students' engagement in reading is the time they spend reading for enjoyment. It was found that, in Australia, students who devoted more time to reading for enjoyment obtained higher scores for the reading domain in PISA than those who spent less time. This variable accounted for 8.6 per cent of the within school variance and 1.2 per cent of between school variance. The challenge for schools, then, is to provide an environment in which students are not only exposed to reading as a necessary part of the curriculum, but an environment that also encourages the students to see reading as a leisure-time activity and source of enjoyment. Internationally, Australia's result was no different from the average across the OECD as a whole on this variable, indicating that there is considerable room for improvement.

Comfort with using computers

To gain a measure of this variable, students were asked questions about their computer usage and how confident they were with using them. Students who were comfortable in the use of computers scored at a higher level in the reading assessment than those who were not. The association with reading score may arise from the students' ability to obtain information from sources such as the Internet. The association may also result from a more generally heightened confidence level displayed by the students in their approach to other stimulus materials and information sources, not just to computers.

Confidence and self-efficacy

In PISA the variable which is named self-efficacy gives an indication of students' level of confidence in approaching new and difficult tasks. Students were asked, for example, to respond to items like, 'I'm confident that I can do an excellent job on assignments and tests'. It was found that students with a higher level of confidence scored more highly in the reading assessment. PISA itself may have been a new and challenging situation for many students – with its extensive coverage of the three domains requiring a sustained effort from students over a two-hour assessment period.

Student expectation and determination

The PISA variable *student expectation* relates to the determination of students to achieve things, even when that may be difficult. Students were asked to respond to questions like, 'When I sit myself down to learn something really difficult, I can learn it.' This determination to do well was positively associated with PISA reading scores.

School level variables (Level 2 factors)

The use of hierarchical linear modelling allows further exploration of the variables that are associated with student outcomes. The procedure allows an assessment to be made of the association that school characteristics may have with reading achievement as measured by PISA. These variables are known as Level 2 factors. School level characteristics can be calculated from the Student Questionnaire, by grouping student responses on a school level basis, or from the School Questionnaire, which was completed by each school's principal. School level factors help to explain the between school variance, which in Australia accounted for only 17.4 per cent of the total variance. A large amount of the between school variance has been explained already by the student background factors discussed in the previous section. In addition to the mean SES of the students attending a school, a factor over which most schools have little control, there are a number of other factors over which schools and education systems do have control that are associated with enhanced student outcomes in reading.

More of the variance in reading achievement between schools was explained by student factors than by school factors.

Mean school socioeconomic status

The most significant school factor contributing to explaining the variance between schools in PISA 2000 reading literacy was the mean SES of the school (that is, the mean SES of the students attending the school), as measured from the Student Questionnaire data. In the HLM analysis this variable was investigated to see if it had an association with the mean reading score.

The association was found to be significant and explained 13.9 per cent of the between school variance. There is a positive association between a student's reading score and the mean student SES of the school.

Student perceptions of class disciplinary climate

The students were asked about their perceptions of the disciplinary climate of the English lessons that they attended. The questions sought information on, for example, how long a teacher had to wait for students to settle down at the beginning of a lesson, whether there was much noise and disruption in the class and how well the students worked in the class.

These perceptions were found to be significant in their association with the students' reading scores. The more positive the students' perceptions of the climate, the higher the reading scores obtained. This variable accounted for 2.5 per cent of the between school variance. Although this was found to be the most significant classroom variable in relation to reading literacy achievement, it should be remembered that PISA was not primarily designed to gain information about classrooms – the PISA sample of 15-year-olds is a random sample taken from all the 15-year-old students at each school regardless of which class or which year level they may be in. In addition to this, the student perceptions of disciplinary climate cannot be linked to specific teacher data as no teacher questionnaire was used.

Students' perceptions of the disciplinary climate of their English classes were related to their reading achievement – the less disciplined the class, the lower the achievement scores.

PISA has shown that students are aware of the nature of their learning environments and that there is an association between their perceptions of the environment and reading literacy scores. Having teachers who are able to create a manageable learning environment in which students are able to take advantage of opportunities afforded them appears to be very important.

Principals' perceptions of teacher morale

A significant school factor in explaining variance was the principals' perceptions of the morale of teachers. Principals were asked to respond to questions about the enthusiasm of the teachers at their schools, whether the teachers took pride in the school and how much they valued academic achievement. Taken together, a variable was constructed that was found to have a significant positive association with reading scores achieved by the students in PISA.

The connection that enthusiastic teachers make with the students in their care brings both short term and long term benefits. In the short term, as shown in PISA, students will be more likely to experience better learning outcomes, probably through a greater involvement and interest in the lessons; in the longer term, enthusiastic teachers may be able to instil a greater love of learning itself, than teachers who engage the students less.

School size

The analysis of school factors in PISA 2000 in Australia showed a slight positive association between school enrolment size and reading score. Although the effect was small, it was significant, and was in accord with findings in the international sample. It is worth noting that the relationship was found internationally to hold for schools with enrolments of up to 1000 students, after which it became very weak.

School size was positively related to achievement for schools with up to 1000 students enrolled. In bigger schools, there was no relationship.

It must also be remembered that this analysis is on the basis of reading scores only – one should caution against saying that larger schools are 'better'. There are many other factors that contribute to judgements of school success, such as students' attitudes, sense of belonging, self-concept development and so on, to name but a few. Smaller schools may provide a more conducive environment than larger schools for the development of some of these characteristics.

Figure 8.1 represents the total amount of variance explained by each of the factors that has been discussed. It can be seen that a large amount of the variance between schools can be explained by those factors. (The vertical axis shows amounts of variance, in terms of squared standard deviations on the reading literacy measure, where the standard deviation of the results across the OECD was set to 100.) It can also be seen that, by far, the greatest amount of unexplained variance is within school variance. This remaining unexplained variance is most likely be due to differences in students' abilities and many other characteristics that were not identified by the PISA measures.

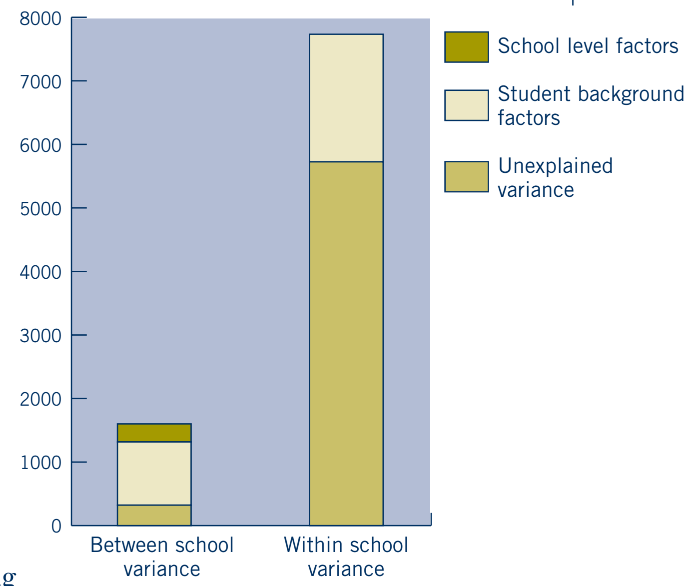


Figure 8.1 Variance Components for Reading Literacy in Australia

A note on student–teacher ratio

There were some factors that were significant in the combined OECD sample that were not significant in the Australian context. It should be remembered that one of the reasons why there were relatively few significant factors in the analysis of Level 2 variables in Australia may be that there is a comparatively small total percentage (17.4 per cent) of between school variance in Australia. The larger percentages of between school variance observed in some other countries suggest that it is more likely that there will be a greater number of school factors significantly related to achievement in those countries.

Student–teacher ratio is a factor that had some significance internationally, but not in Australia. This variable was calculated in PISA by dividing the total number of students at a school by the number of teachers (including those in administrative positions) at the school, and so it is not necessarily an accurate measure of average class size. For reference, the mean student-teacher ratio for Australia was calculated to be 13.8. In the international sample it was found that student–teacher ratios which were very small (less than 9) or very large (greater than 25) both had a negative association with reading literacy score. The association of very small ratios with lower achievement is possibly related to the fact that the smaller classes may be specialised classes to assist students with learning difficulties, as was found to be the case in TIMSS.

Student–teacher ratio was related to reading achievement internationally, but not in Australia.

For each school it is possible to plot the mean of the reading score for the school against the mean SES of the students at the school. This is shown in Figure 8.2.

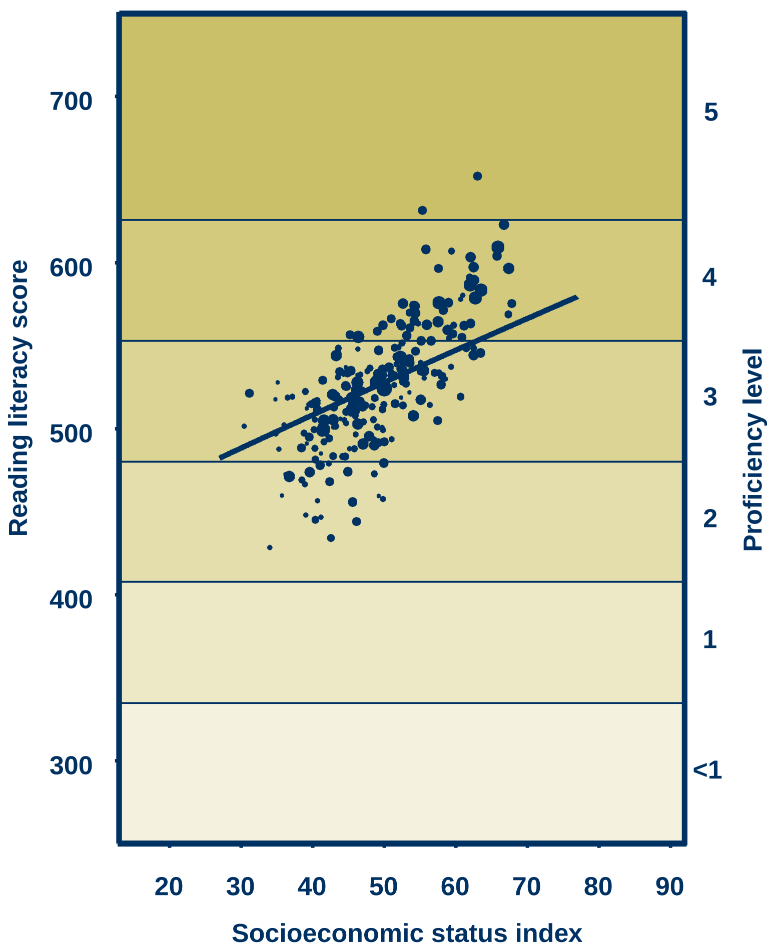


Figure 8.2 Mean School SES and School Size Plotted Against the Mean Reading Literacy Score for Each School in the Australian Sample

Each dot represents a school and its size is proportional to the size of the school. When examining this graph, the schools with higher reading scores than might otherwise be expected are of particular interest. The characteristics of these schools could provide useful information on resilience to background factors such as low student SES, which is considered in a later section of this chapter. The graph also has on it the line representing student scores in reading plotted against their individual socioeconomic status. This is the same line as shown in previous graphs.

>> *Multilevel analysis for mathematical literacy*

The results for mathematical literacy can be analysed in the same way as for reading. The HLM process was used to examine the contribution that each of the factors makes in explaining the variance within schools and between schools.

The factors that were found to be significant are listed in Table 8.3, which also shows the amount of total variance that each of those factors accounted for. The model explained a total of 88.8 per cent of the between school variance and 22.5 per cent of the within school variance. As for reading literacy, much of the within school variance was not explained by the data collected in PISA.

Student background (Level 1) factors

Although the most important factor associated with student achievement in mathematical literacy was socioeconomic status, there were some interesting differences for mathematical literacy when compared to the factors that were significant for reading literacy. For mathematical literacy there was a larger number of factors associated with the students' approaches to school and learning and a smaller number of home background factors. The techniques that the students said they employed in their learning were significant. It appears that mathematical literacy is more dependent on school factors than reading literacy is.

Strategies used by students in their learning were significantly related to achievement in mathematical literacy ….

Some of the student background factors that were not significant in mathematical literacy that were significant in reading literacy are the level of home education resources, whether the student lived with a guardian and student immigration status.

The factors that were significantly associated with mathematical literacy but which were not significantly associated with reading literacy include students' attitudes to computers, strategies used to control their learning processes, the use of memorisation in learning, and techniques of elaboration of existing knowledge to promote their learning. Details of factors not already described in this chapter can be found in Appendix 2.

Table 8.3 Variance Decomposition for Mathematical Literacy in Australia

Factor	Percentage of between school variance accounted for	Percentage of within school variance accounted for
Gender	5.2	2.7
Socioeconomic status	43.8	7.7
Family wealth	9.9	1.3
Parents' education	3.8	0.9
Number of siblings	2.6	0.4
Time spent on homework	10.4	2.4
Comfort with computers	0.0	0.4
Attitude to computers	1.2	0.8
Control strategies in learning	0.0	0.6
Memorising strategies in learning	0.9	1.9
Confidence and self efficacy	0.0	2.0
Student determination to do well	0.0	0.3
Elaboration strategies in learning	0.0	0.5
Mean school SES*	3.8	0.3
Disciplinary climate*	2.5	0.1
Teacher support*	4.4	0.1
Teacher morale*	0.3	0.0
Total variance accounted for	88.8	22.5

* School level variables

School level variables (Level 2 factors)

When the mean socioeconomic status of the school was placed into the model as a Level 2 variable, it was found to account for 3.8 per cent of between school variance. There was thus a positive association between a student's mathematical literacy score and the mean socioeconomic status of the school, although this was not as large as it was for reading literacy. It can be seen in Figure 8.3 that the schools are clustered closer to each other than they are for reading and show less deviation from the line of best fit. Each dot represents a school with its size proportional to the size of the school. The graph also includes the line representing student scores in mathematical literacy plotted against their individual socioeconomic status.

…. as was support received from their teachers.

The school's disciplinary climate was also significant in mathematical literacy, as it was in reading literacy. The other factor that was significant was the amount of support from the teacher that the students said they received. This was not a significant factor in reading literacy.

Multilevel analysis for scientific literacy

The results for scientific literacy have been analysed in the same way as for reading and mathematical literacy.

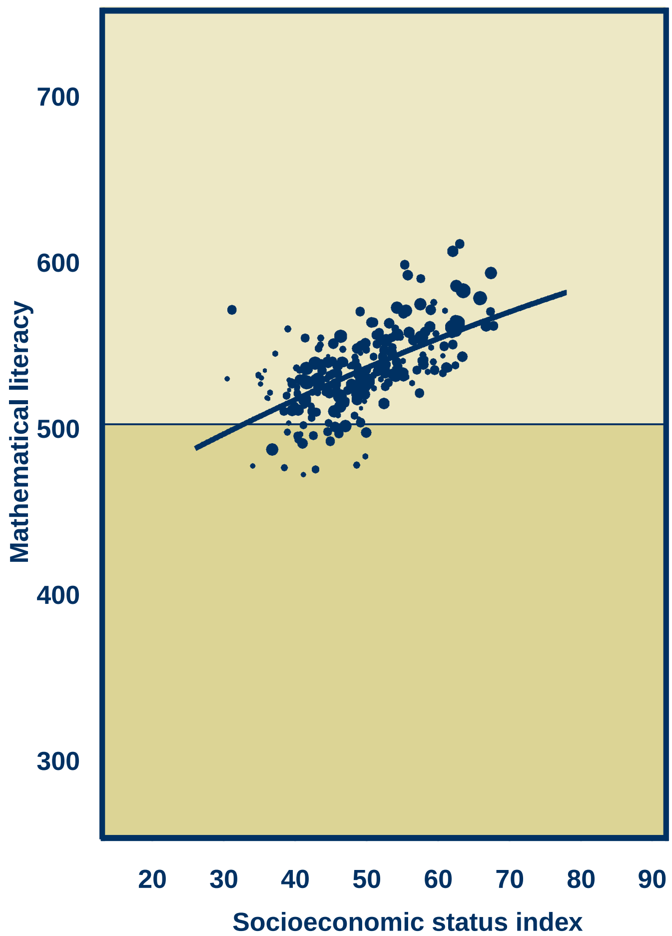


Figure 8.3 Mean School SES and School Size Plotted Against the Mean Mathematical Literacy Score for Each School in the Australian Sample

Student background (Level 1) factors

The factors that were found to be significant are listed in Table 8.4, which also shows the amount of total variance that each of those factors accounted for. The model explained a total of 75.9 per cent of the between school variance and 17.8 per cent of the within school variance.

Although most of the factors associated with achievement were dealt with in some detail in the previous sections on reading literacy and mathematical literacy, there were some interesting differences for scientific literacy when compared with the factors that were important in the other domains. For scientific literacy there was a larger number of home background factors associated with achievement than there was for mathematical literacy – although the techniques that the students employed in their learning were still significant. The number of cultural possessions in the home was a significant variable in relation to scientific literacy achievement but not to reading or mathematical literacy achievement. Details of factors not already described in this chapter can be found in Appendix 2.

More home background factors were related to performance in scientific literacy than in mathematical literacy.

A major difference with scientific literacy compared with reading literacy was that gender was not a significant factor associated with achievement. This supports the observations in previous chapters.

Table 8.4 Variance Decomposition for Scientific Literacy in Australia

Factor	Percentage of between school variance accounted for	Percentage of within school variance accounted for
Socioeconomic status	25.0	6.9
Family wealth	9.8	0.7
Home educational resources	0.8	2.1
Cultural possessions	6.2	0.3
Parents' education	3.0	0.2
Living with a guardian	0.0	0.2
Immigrant status	0.4	0.7
Number of siblings	0.3	0.2
Time spent on homework	7.1	2.1
Comfort with computers	0.0	1.0
Attitude to computers	1.1	0.3
Control strategies in learning	0.0	0.9
Social communication	0.6	0.4
Student determination to do well	0.0	0.6
Elaboration strategies in learning	0.0	0.7
Mean school SES*	6.1	0.3
Disciplinary climate*	4.5	0.0
Teacher support*	4.9	0.0
Achievement press*	1.7	0.0
Instruction time*	4.3	0.1
Total variance accounted for	75.9	17.8

* School level variables

School level variables (Level 2 factors)

There were more school level variables that are significant in scientific literacy than in the other domains. Table 8.4 shows that the time devoted to instruction was associated with achievement – this was not a significant factor in the other domains. The significant relationship may be because of a greater amount of variation from school to school in science instructional time than there is for the other domains, as was found in TIMSS for science compared with mathematics (Lokan, Ford & Greenwood, 1996). Schools with a focus on improving science outcomes for their students could consider an increase in the time allocation for the subject.

The amount of instructional time in science was related to achievement in scientific literacy.

Figure 8.4 shows the Australian schools plotted with their mean science score against their mean SES. Each dot represents a school, with its size proportional to the size of the school. The spread of schools is greater than it was for mathematical literacy, but not as much as for reading literacy.

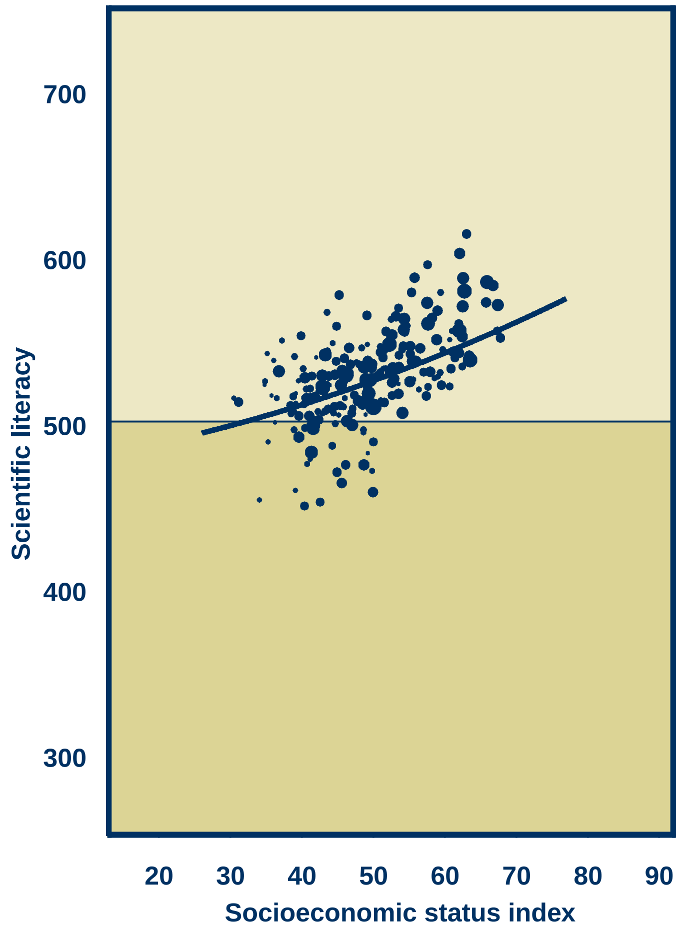


Figure 8.4 Mean School SES and School Size Plotted Against the Mean Scientific Literacy Score for Each School in the Australian Sample

A comparison of some Australian schools

An examination of some individual schools in the sample provides an opportunity to examine the characteristics of schools in which the students scored highly in PISA in comparison with schools in which the scores were the lowest. It also allows a further consideration of the association of socioeconomic status with achievement.

The three graphs in Figures 8.5 to 8.7 are similar to the previous graphs that showed the schools in the Australian sample plotted according to their mean SES, mean achievement scores and school size. However, some individual schools have been identified on the graphs and assigned a letter code. Also plotted on the graph is the line of best fit for the mean school SES and the mean school achievement scores, which is an indicator of the average result of these two values plotted against each other. The dotted line is the student SES by achievement score plot as shown in the previous graphs.

Some interesting features emerge. School A was the highest scoring school in all three domains. It also had one of the highest mean school socioeconomic status scores. School A had over 800 students, who achieved a mean reading score of 652. In responding to the Student Questionnaire, students at School A had the highest 'Interest in Reading' score in the Australian sample and had high scores in measures of confidence and self-efficacy. There was also a larger than average number of immigrant students at the school.

Characteristics of schools achieving at particular levels in relation to their SES are described for several individual schools.

The school with the highest mean SES was School E. Although the students scored highly in reading literacy, the mean reading score at the school was, in fact, below the average line of best fit, though was probably within the limits of measurement error. It could be suggested that, with a school SES of 67.8 (18.8 above the mean of the school means which was 49.0[2]), the students at School E should have, in fact, scored higher than they did. The mean results for School E were also below the average line of best fit for mathematical literacy and scientific literacy.

In mathematical literacy, School D, the school in the sample with the lowest average SES (30.5), achieved a mean of 527, above the international mean of 500. This compares to a mean mathematical literacy score for School E (the school with the highest mean SES) of 559. The difference between the two scores is less than one standard deviation for the distribution of school means.

Schools B, C and D are all of some interest because they had a low mean school SES but scored well above the average line. With regard to school size, none of the three schools had more than 900 students and two of them had fewer than 400 students. In the whole Australian sample, however, larger school size was associated with a slightly higher score in reading literacy. It can also be seen that there are some small schools below the line of best fit. It appears that school size was probably not the key factor in the success of schools B, C and D, although this warrants further investigation.

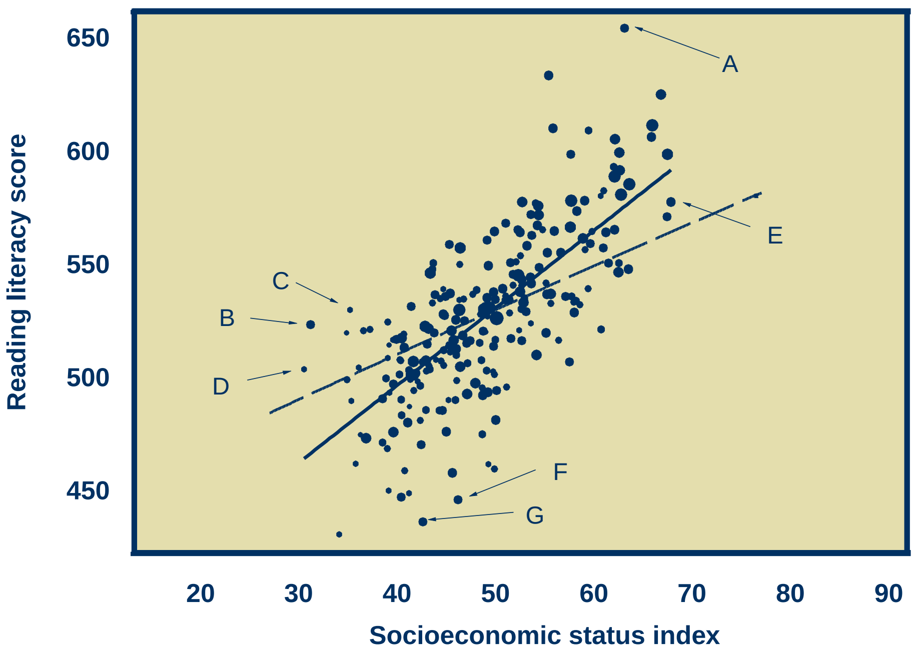


Figure 8.5 Mean School SES and School Size Plotted Against the Mean Reading Literacy Score by School, with Specific Schools Indicated

2 This mean is different from the mean of all the students in the Australian sample, which was 52.2. This is because each school is counted as being equal in this calculation, so students from a smaller school make a proportionately larger contribution to the mean.

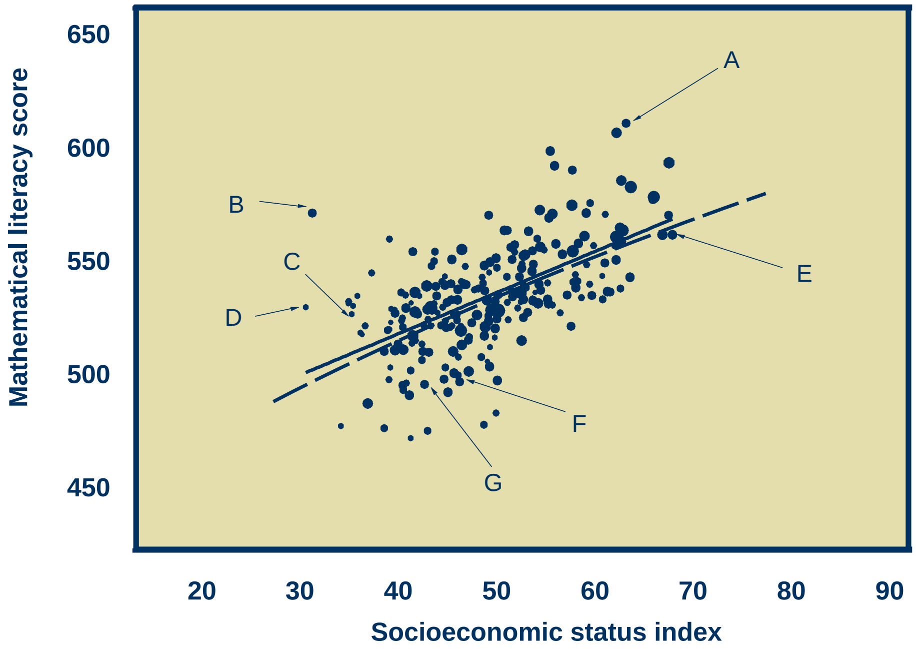


Figure 8.6 Mean School SES and School Size Plotted Against the Mean Mathematical Literacy Score by School, with Specific Schools Indicated

The students at schools B, C and D all reported lower than average access to home educational resources and cultural possessions in their households, but, on average, read a wider range of materials than other students in the Australian sample. The ways in which they gained access to these materials are not known, but, by putting these two observations together, one can conclude that the access was probably gained outside the students' immediate home environment.

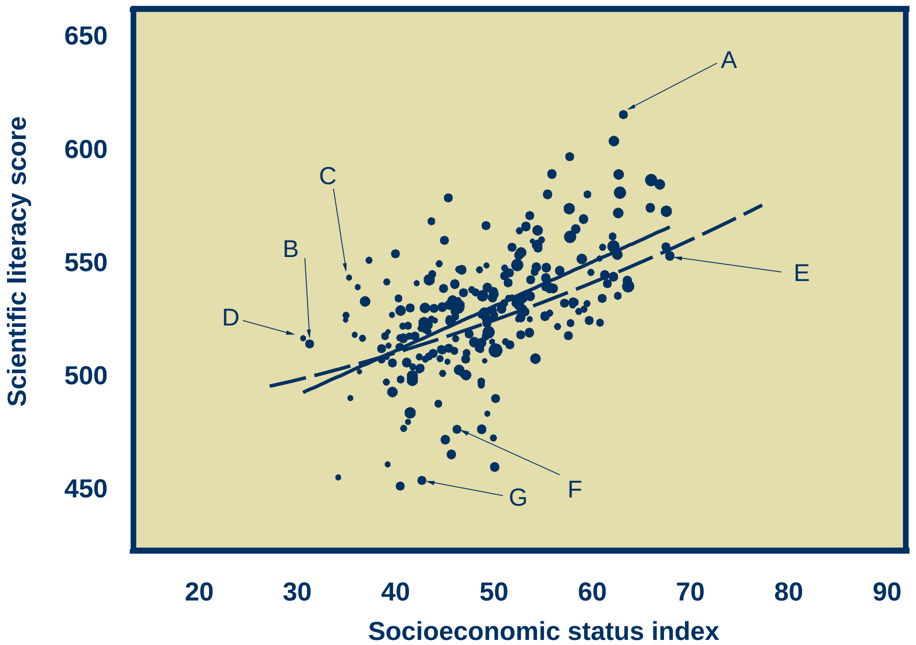


Figure 8.7 Mean School SES and School Size Plotted Against the Mean Scientific Literacy Score by School, with Specific Schools Indicated

The level of teacher morale was also investigated to see if it was a characteristic associated with these schools. In School B, teacher morale was rated as very high by the principal, but in Schools C and D it was rated lower than average. In two of the schools, principals reported a higher than average value for teacher-student relationships.

School B, an outlier to the main set of results in reading literacy, scored even higher in mathematical literacy. It had the second lowest mean SES, but scored in the top 20 per cent of school means for mathematical literacy. In the area of lower-scoring schools, the students in schools F and G obtained higher means for mathematical literacy than they achieved for reading literacy.

While it is difficult to identify common characteristics of schools B, C and D, these schools are important simply because they demonstrate that it is possible to achieve relatively high scores regardless of the socioeconomic status of their students.

>> *Summary*

This chapter provides an analysis of the variance in student achievement scores in reading, mathematical and scientific literacy in PISA 2000.

It shows that there was less difference between schools in Australia than there was in some other countries. In Australia, variance between schools accounted for about 17 per cent of the total variance – a figure lower than in countries, such as Austria, where students follow definite education tracks in different sorts of schools; but a figure not as low as in some of the Scandinavian countries, where all the schools are comprehensive and directed by the same authority.

A multilevel analysis of the achievement scores yielded a two-level model which included a large number of student background and school based variables in an attempt to explain the variance in results that occurred between students. A large proportion of the between school variance could be explained for each of reading, mathematical and scientific literacy, but a large proportion of the within school variance remained unexplained.

A number of factors contributed significantly to explaining the variance in all three domains. In this analysis, the amount of variance explained by each factor is for that factor alone, after the variance explained by the other factors has been taken account of. Socioeconomic status and wealth were the most significant factors in all three domains. Disciplinary climate was also a significant factor as was the amount of time devoted to homework.

Some other factors were significant for only one or two of the domains. In mathematical and scientific literacy, for example, the techniques and approaches that students applied to their learning were more significant than in reading literacy. The amount of instructional time in science was a significant factor in scientific literacy achievement, but instructional time was not significantly related to reading or mathematical literacy scores.

Low SES schools that achieved above average results were examined in more detail. No obvious similarities were found between some of these schools, although it appeared that the quality and enthusiasm of the teachers at the schools were contributing factors.

Chapter NINE

WHO ARE THE HIGH AND LOW ACHIEVERS?

So far in this report, information has been provided on high and low achievers at country level, and, within Australia, at state level as well as for various groups of students. This chapter focuses on characteristics of groups of students within Australia in more detail. A series of tables is presented to describe groups of students who scored at Level 5 (high achievers) and at or below Level 1 (low achievers) in reading literacy. An analogous set of tables is presented for mathematical literacy. In the sample as a whole, 12 per cent of the students were placed at reading proficiency Level 1 or below and 18 per cent were placed at reading proficiency Level 5. Twelve per cent of the sample represents about 27 350 students in the population and 18 per cent represents about 41 100 students. Table 9.1 summarises the student background characteristics of the sample as a whole, and of the low- and high-achieving groups in reading literacy. Table 9.2 is the corresponding table for mathematical literacy. Data for scientific literacy were not analysed for this chapter.

Table 9.1 Characteristics* of Low- and High-Performing Groups in Reading Literacy

Characteristic	Australia	Students at Level 1 or below	Students at Level 5
Indigenous	2.4	6.5	0.6
Year 8 or 9	6.8	17.8	1.0
Male	52.2	66.7	41.1
Born in Australia	87.3	79.7	87.8
Speak English at home	83.0	75.0	88.4
Speak Indigenous language at home	0.3	0.8	0
Have no more than 50 books in the home	20.0	40.5	6.5
Mother completed university degree	30.8	18.3	47.8
Father completed university degree	33.5	18.5	53.7

* Data in the table show the percentage of each group with the given characteristic.

Table 9.2 Characteristics* of Low- and High-Performing Groups in Mathematical Literacy

Characteristic	Australia	Students at or below score 400	Students at or above score 600
Indigenous	2.4	8.2	0.5
Year 8 or 9	6.8	18.1	1.8
Male	52.2	50.2	59.4
Born in Australia	87.3	84.0	86.7
Speak English at home	83.0	77.6	86.3
Mother completed university degree	30.8	14.8	47.5
Father completed university degree	33.5	11.2	51.5

* Data in the table show the percentage of each group with the given characteristic.

Students still in Year 8 or Year 9 are over-represented in each of the low-achieving groups, as are Indigenous students. There is an over-representation of males in the low-achieving reading group compared with the sample as a whole. Students born in Australia were equally represented in the low and high-achieving groups for mathematics but not for reading, where there was a difference of almost 10 per cent between the low- and high-achievers. More of the high achievers in reading and in mathematics spoke English at home than in the low-achieving groups. The largest differences between the low- and high-achieving groups were in the percentages of mothers and fathers who had completed a university degree. These percentages were about three times higher for mothers and up to more than four times higher for fathers of students in the high-achieving groups than in the low-achieving groups. Among Indigenous students, the percentages of females and males who were placed in the low-achieving group were the same, in contrast with the non-Indigenous group where males outnumbered females by two to one (these results are not included in the table).

For interest, the percentages shown in Table 9.1 are displayed in Table 9.3 as numbers of students in the population who are estimated by the sample data to be in each category.

Table 9.3 Population Distribution as Estimated from Low- and High-Performing Groups in PISA Reading Literacy

Characteristic	Australia (weighted *N* = 228 331)	Students at Level 1 or below (weighted *N* = 27 400)	Students at Level 5 (weighted *N* = 41 100)
Indigenous	5 500	1 781	247
Year 8 or 9	15 526	4 877	411
Male	119 189	18 276	16 892
Born in Australia	199 333	21 838	36 086
Speak English at home	189 515	20 550	36 332
Speak Indigenous language at home	685	219	0
Have no more than 50 books in the home	45 666	11 097	2 671
Mother completed university degree	70 326	5 014	19 646
Father completed university degree	76 491	5 069	22 071

Data on some variables about student behaviours are presented in Table 9.4 for reading literacy. The variables analysed pertain mostly to reading and hence were not analysed for describing high- and low-achievers in mathematics.

Table 9.4 Behaviour Patterns* of Low- and High-Performing Groups in Reading Literacy

Behaviour	Australia	Students at or below Level 1	Students at Level 5
Do only up to an hour of homework per week	41	56	28
Sometimes or always do homework while watching TV	61	63	55
Do not read for enjoyment at all	33	59	13
Read for enjoyment for no more than half an hour a day	64	85	42
Use the school library several times a month or more	36	28	43
Never borrow books from the library	38	53	20
Parents discuss books with me	43	27	66

* Data in the table show the percentage of each group reporting occurrence of each behaviour.

Apart from doing homework while watching TV, which students at all levels of achievement said they did frequently, there is a clear and predictable pattern of differences in homework and reading habits between the low- and high-achieving groups.

Some background characteristics that were measured as scales are presented, together with the results on some attitudinal variables, in Table 9.5 for reading literacy and in Table 9.6 for mathematical literacy. For details of the variables analysed, see Appendix 4.

Table 9.5 Scale Means* on Background and Attitudinal Variables for Low- and High-Performing Groups in Reading Literacy

Scale	Australia	Students at Level 1 or below	Students at Level 5
Higher of parents' occupational status (scale from 0 to 90)	52.3	44.2	60.3
Home educational resources	.05	-.45	.27
Sense of 'belonging' at school	-.05	-.20	-.01
Academic self-concept	.08	-.25	.48
Verbal self-concept	.13	.08	.30
Self-efficacy	-.09	-.22	.47
Interest in reading	-.02	-.37	.50
Reading diversity	-.05	-.37	.40
Comfort and perceived ability with computers	.43	.09	.59

* Many of the scales were standardised to a mean of zero and standard deviation of one for the OECD as a whole. Positive values are above the OECD average and negative values are below it (though may not be significantly above or below if close to zero).

Table 9.6 Scale Means* on Background and Attitudinal Variables for Low- and High-Performing Groups in Mathematical Literacy

Scale	Australia	Students at or below score 400	Students at or above score 600
Higher of parents' occupational status (scale from 0 to 90)	52.2	42.7	60.0
Home educational resources	.05	-.43	.26
Sense of 'belonging' at school	-.05	.01	.02
Academic self-concept	.08	-.25	.48
Mathematics self-concept	.16	-.16	.54
Self-efficacy	-.09	-.22	.47
Interest in mathematics	.06	-.15	.20
Comfort and perceived ability with computers	.43	.14	.66

* Many of the scales were standardised to a mean of zero and standard deviation of one for the OECD as a whole. Positive values are above the OECD average and negative values are below it (though may not be significantly above or below if close to zero).

These two tables show that there were moderate differences in mean socioeconomic status between the low- and high-achievers, and relatively larger differences on the *home educational resources* scale. There was no difference between the mathematics groups in sense of belonging at school and some difference, though not as large as for other scales, between the reading groups on this variable. The high achievers had better academic and mathematics or verbal self-concepts than the low achievers and had greater belief in their own ability to accomplish things, as evidenced by their self-efficacy scores. The difference between high and low achievers was more than twice as great for interest in reading than it was for interest in mathematics. Finally, all groups, including the low achievers, had scores on the *comfort and perceived ability with computers* scale that were above the OECD average. The differences on this scale between the high- and low-achieving groups in each of reading and mathematics were comparable, equal to half a standard deviation on the scale.

Summary

Data on the home and educational backgrounds of students who were placed at or below Level 1 in reading proficiency were compared in this chapter with data on the same variables for students at Level 5 in reading proficiency. Similar comparisons were made between low and high achievers in mathematical literacy, defined in terms of being at least one standard deviation from the mean in their mathematical literacy scores. Some behavioural and attitudinal variables were also compared in the same way. The data are provided to build up a picture of students who performed at the high and low extremes in each domain. PISA data are reliable indicators of population data, and provide a unique opportunity to examine characteristics in the whole population or in parts of it.

The results of these analyses, as they should be, are consistent with the results of analyses reported in earlier chapters of the report. Males were shown to be over-represented in the low-achieving reading group but over-represented (though not to the same extent) in the high-achieving mathematics group. Indigenous students are over-represented in the low-achieving groups and under-represented in the high-achieving groups. There were only small differences between the high and low groups in terms of student's country of birth and language spoken at home. Many more students in the low-achieving groups than in the high-achieving groups were still in Year 8 or 9 at the age of 15. There were differences in the students' homes in terms of socioeconomic status and extent of availability of educational resources to help them in their learning.

In terms of behaviour, students at both ends of the achievement spectrum did most of their homework while watching TV, but many more in the low group reported doing no more than an hour a week of homework altogether. On average, the students who were the best readers used the school library, borrowed more library books and read more for enjoyment than the students who were poor readers, and their parents discussed books with them more than twice as much as was the case for the low-achievers in reading. The attitude scale means of students who were poor readers were typically much lower than the means of the good readers, who had better self-concepts and belief in their ability to achieve. Apart from a sense of belonging at school, similar differences in attitudes were found between the low- and high-achievers in mathematics as in reading.

The findings reported in this chapter reinforce beliefs about the unfavourable situation in which low achievers are placed. It remains a challenge to create education programs to improve their motivation, attitudes and behaviours.

Chapter **TEN**

SUMMARY AND POLICY ISSUES

This report has focused on a wide range of results and issues arising from the data collected in 2000 in the Programme for International Student Assessment (PISA).

PISA, an initiative of the Organisation for Economic Co-operation and Development (OECD) in Paris, began in 1998 and its first international assessment was carried out in 2000 on more than a quarter of a million students from 32 countries. Further assessment cycles are planned for at least the next decade (work on PISA 2003 is already in progress). The domains of learning chosen for assessment in PISA are reading, mathematical and scientific literacy. Each of these is planned to be the major assessment focus in successive three-yearly cycles. Thus, reading literacy was the major domain in PISA 2000, mathematical literacy is to be the major domain in PISA 2003 and scientific literacy is to be likewise in PISA 2006. Data on all three domains are gathered in each cycle but there is about four times as much emphasis on the major domain, in terms of testing time, than on each of the other two domains.

PISA's assessment materials focus on young people's ability to apply their knowledge and skills to real-life problems and situations, rather than on how much curriculum-based knowledge they possess. The emphasis is on whether students, faced with problem situations that might occur in real life, are able to analyse, reason and communicate their ideas, arguments or conclusions effectively. The term 'literacy' is attached to each domain to reflect the focus on these broader skills. In the way that the term is used, it means much more than the traditional meaning of being able to read and write. The OECD considers that mathematics, science and technology are so pervasive in modern life that it is important for students to be 'literate' in these areas as well.

The population of interest in PISA is 15-year-old students.[1] Students of this age are typically in their last year of compulsory schooling in most OECD member

[1] In practice, because of the way the birth date period for eligibility for selection in the sample was defined, the students were aged between 15 years 3 months and 16 years 2 months in all countries. For convenience, the students are usually referred to as '15-year-olds' in reports on the study.

countries. Measures of key knowledge and skills that should enable the students to cope successfully in their lives beyond school, when accompanied by information about their home backgrounds and experiences, provide an assessment of the cumulative yield of education systems. Such an assessment can be useful in guiding decisions on education policy for the future.

The procedures put in place in PISA ensure that the data encapsulate reliable measures of yield that are comparable across countries in terms of both the content of the measuring instruments and the student population in which the measurements were made. The many steps taken to maximise the quality of the data are summarised in Appendix 1.

PISA 2000 was implemented internationally by a consortium led by the Australian Council for Educational Research (ACER). Other members of the consortium were The Netherlands National Institute for Educational Measurement (CITO), the Educational Testing Service (ETS) and Westat Inc. of the United States, and the National Institute for Educational Research (NIER) in Japan. The University of Liège in Belgium was also a member of the consortium in the initial stages of the project.

An important feature of PISA 2000 at international level, which will continue in subsequent cycles, is the collaborative way in which the assessment frameworks and measuring instruments are developed. All OECD member countries contributed to the evolution of the assessment frameworks and materials through processes of review and consultation, offering comments and, from most countries, submitting sample assessment materials. A governing body called the Board of Participating Countries, on which each participating OECD country is represented, made policy decisions on most aspects of the implementation of PISA, including the frameworks and assessment measures.

PISA in Australia

About 6200 students from 231 schools participated in PISA in Australia. The assessment was carried out between mid-July and the end of August 2000, a few months later than in Northern Hemisphere countries so that students would be at approximately the same stage of the school year. The birth-date period for age-eligibility was adjusted so that the students assessed in Australia would be the same age, on average, as those assessed in other countries. Results for about 5500 students are the focus of this report. A further 700 students answered a special booklet containing a mixture of assessment items from PISA and from the Third International Mathematics and Science Study (TIMSS), so that an estimate of change in mathematics and science performance between those two studies could be obtained. The results from this exercise will be reported separately from this main report.

A brief summary of Australia's achievement results is presented next. This is followed by a summary of findings on contextual variables, considered both separately and jointly, in relation to achievement. The final section of the chapter discusses some policy issues arising from the findings.

>> *Australia's achievement results from international and national perspectives*

All countries that were members of the OECD in 1999, except Turkey, took part in PISA, as well as four additional countries which participated at their own request (see Figure 1.1 in Chapter 1). The additional countries were Brazil, Latvia, Liechtenstein and the Russian Federation.

The Australian students acquitted themselves very well in all the assessment domains. Their results were significantly above the OECD average in all areas (apart from on some of the attitudinal measures, which are discussed separately in a later paragraph). Taking statistical significance into account, only Finland performed better than Australia in reading literacy, only Japan did likewise in mathematical literacy and only Korea and Japan outperformed Australia in scientific literacy. Considering only the highest-performing five per cent of students in each country, Australia's record was even better, in that no country performed at a statistically significant higher level.

Based on the content of the PISA assessment measures together with a consideration of students' performance across all the participating OECD countries, five levels of proficiency in reading literacy were defined and used for reporting purposes. As well as for the reading literacy measure as a whole, levels were defined for the three main organising categories specified in the assessment framework to indicate the reading processes needed in responding to the assessment tasks. These aspects are retrieving information, interpreting texts, and reflecting on and evaluating texts. To accompany each level of each reading aspect, descriptive scales were developed to enhance the meaning of PISA results. Thus in addition to having students grouped by their proficiency levels, it is also possible to obtain a picture of the skills and knowledge that students at each level typically possess (see Table 3.1 in Chapter 3).

Level 5 is the highest proficiency level defined and Level 1 the lowest. In each country there were students who were unable to do even the easiest items in PISA. It is not known what the literacy skills of these students are, and hence they are classified as not reaching Level 1, with no assumptions about what they may be able to do. In Australia, three per cent of students were in this category, compared with the OECD average of six per cent. In Finland only two per cent of students were in this category, while in New Zealand, another high-performing country, the corresponding result was five per cent.

At the other end of the proficiency scale, 18 per cent of Australia's students achieved the highest level, compared with the OECD average of ten per cent. Finland and New Zealand were the highest countries in this respect, each with 19 per cent of their students achieving Level 5. In Australia, 21 per cent of students reached Level 5 in retrieving information (highest was Finland, at 26 per cent); 18 per cent reached Level 5 in interpreting texts (again, Finland was highest, at 24 per cent); and 16 per cent reached Level 5 in reflecting on and evaluating texts (highest was the United Kingdom, at 20 per cent).

Students at Level 5 in reading proficiency successfully coped with some very sophisticated reading tasks. They were able to manage information that was difficult to find in texts that were not familiar to them; to show detailed understanding of complex texts, infer which information was relevant to the task and use the information appropriately; to evaluate texts critically; to accommodate concepts that would have been contrary to expectation; and to draw on their knowledge to build up tenable hypotheses about aspects of texts.

In terms of other proficiency levels, over 40 per cent of the Australian students were placed at Level 4 or higher and two-thirds were placed at Level 3 or higher. Corresponding figures for the OECD as a whole were 32 per cent at Level 4 or higher and about 60 per cent at Level 3 or higher. Only 12 per cent of Australia's students did not reach at least Level 2, compared with the OECD average of 18 per cent.

Without the opportunity as yet to follow students into the labour market or further study, PISA has not attempted to define what constitutes a minimum level of reading literacy for full participation in adult society. There is strong evidence from other studies, some of which were carried out in Australia, that, other things being equal, students with higher levels of reading literacy skills achieve more satisfactory outcomes in the labour market. It seems likely that the group not reaching Level 2, and probably some of those who did reach Level 2, will experience difficulties in their lives beyond school unless they can be helped to improve their reading literacy skills.

At the level of individual assessment items, Australia performed above the OECD average on all the mathematical literacy items, on all but one of the scientific literacy items and on all but a handful of the reading literacy items. Despite this impressive relative performance, a closer examination revealed areas where there is plenty of room for improvement in our students' skills. In reading, they coped better with what are referred to as 'non-continuous' texts (forms, timetables, tables, schematic diagrams, and so on – texts where the reading content as such is more fragmented and generally less difficult) than they did on 'continuous' texts, particularly narrative text. In mathematics, they had more success with items on statistics and functions than they did with algebra and measurement items, and they fared better on multiple choice items than on items requiring them to write in their answers. In science, our students' performance was stronger on items assessing understanding of scientific investigations than on items assessing understanding of concepts.

The performance of all the Australian states and territories, on average, was either at or above the OECD average. Although there were differences in scores between the states and territories in all domains, not many of the apparent differences were statistically significant. However the Australian Capital Territory was placed highest on each achievement chart and the Northern Territory was placed lowest. Several comparisons with the Australian Capital Territory's results and the Northern Territory's results, and one or two with Tasmania's, showed significant differences.

Comparisons of achievement among the Australian states revealed a more uniform picture than was found in the TIMSS survey in 1994, where the sampling was based on year level rather than on age. Differences in school starting age policies around Australia create difficulties for the interpretation of results from comparative studies no matter how the sampling is done. Towards the end of secondary education, however, the effects of confounding of age with year level are expected to be not as great as they would be at primary and lower secondary levels. Authorities in the states and territories are each familiar with their own situation, and are in the best position to assess the relative effects of these sampling parameters.

Gender differences in achievement were analysed both for Australia as a whole and separately within state or territory. An examination of gender differences was of particular interest for two reasons: one, the current debate in Australia and elsewhere about what many assume to be a decline in boys' academic performance, and the other, the progress made in Australia towards gender equity in mathematics and science that was revealed in the mid 1990s in TIMSS.

There were gender differences in all areas of reading literacy achievement for Australia as a whole, and also within each of the states and territories. The analyses showed that females, on average, achieved between 20 and 50 more points than males, on a scale with a mean of 500 and a standard deviation of 100. For Australia as a whole, the gender discrepancy of 34 points was the same as the OECD average and also the same as in Canada. The greatest discrepancies occurred in Finland (51 points) and New Zealand (46 points), which is interesting given that these two countries were among the highest achievers in reading. For the Australian states and territories, discrepancies of almost 50 points were found in Queensland and Tasmania, considerably higher than in any other state or territory.

No significant gender difference was found in Australia in mean scores on the mathematical literacy and scientific literacy scales. This finding was upheld throughout components of mathematical literacy, analysed as averages of percentages correct on the items grouped in different ways, but not throughout scientific literacy. In scientific literacy, males performed relatively better on understanding of scientific concepts and females performed relatively better on understanding of the processes of scientific investigations. A better opportunity to study the possibility of achievement differences in these subject areas will be afforded for mathematical literacy in 2003 and scientific literacy in 2006, when more assessment time will be devoted to each of them in turn, as the major domain.

An enduring concern in Australian education is the performance of Indigenous students relative to the performance of non-Indigenous students. Altogether, about 500 Indigenous students were assessed in PISA, 200 of whom were part of the main sample and 300 of whom were sampled additionally so that the number of Indigenous students would be large enough for their results to be reported separately. On average, the Indigenous students' performance was more than one proficiency level below the performance of non-Indigenous students in each domain in Australia. With respect to the OECD, their results were not below the results of several countries in each domain. Within Australia, they were over-represented in the group of students who did not reach Level 2 in reading proficiency. However, 40 per cent of them demonstrated skills at least at proficiency Level 3 and some achieved very high results.

Performance in Australia was also analysed according to whether or not the students' home language was English, and according to whether their school was located in a major urban area, a provincial city or a relatively remote area. The 17 per cent of students whose home language was not English performed at an equivalent level in mathematical literacy to the students whose home language was

English, but at a slightly lower level in reading literacy and a lower level in scientific literacy. Students in provincial cities performed on a par with students in major urban areas in all three domains, but students in more remote areas performed less well than their urban and provincial counterparts in reading and scientific literacy.

On measures other than the achievement measures, Australian scores were mixed relative to scores in other countries. Our students were at the same level as the OECD average on the *engagement in reading* scale. On this scale, most countries' results were bunched around the OECD average, with only seven countries achieving significantly higher results than the OECD and only six countries significantly lower. Although this scale was correlated with achievement within countries, across countries there were anomalous results in that Mexico and Portugal scored highest on *engagement in reading* and Belgium and Norway scored lowest, not following their relative positions on the achievement scale. Females had significantly higher *engagement in reading* scores than males in every country.

Australian students registered one of the highest average scores on the *comfort and perceived ability with computers* index. Other high-scoring countries were the United States, Canada, New Zealand and Belgium. The United States' result was significantly higher than all other countries' results. Australian males scored significantly higher than Australian females, but the gender difference was one of the smallest internationally.

On three scales from the *self-regulated learning* measure used as an option in 25 countries, Australia's result was close to the OECD average in use of control strategies and in use of elaboration strategies while learning, but significantly above the OECD average in use of memorisation strategies (for details of the components of these scales, see Appendix 4).

PISA collected data from students on how much homework they did per week in the language of the test, and also in mathematics and science. 'Amount of time' was measured on a 4-point scale, from 'no time' to '3 hours or more a week'. Internationally, a *homework* index was created by scaling together the amounts of time spent on homework in the language of the test, mathematics and science combined. Even though the index was not subject-specific, it was significantly related to reading literacy achievement in most countries, and further analyses in Australia showed that it was also significantly related to achievement in mathematical and scientific literacy. Australia's score on the index was not different from the OECD average. Greece and the Russian Federation were highest above the OECD average on this index and Japan was lowest.

From an international perspective, Australia's score on the teacher support index was one of the highest recorded, well above the OECD average. The highest score on this index was obtained in the United Kingdom. On the index of positive disciplinary climate, Australia was significantly below the OECD average, but by a relatively small amount. Japan was much higher than any other country on this index. Australia scored at the international average on the index of teacher morale. Highest on this index was Austria, followed by Switzerland, and lowest were Korea and Italy.

>> *Commentary on variables related to achievement*

The most important student background variable in relation to achievement in Australia, apart from the gender differences in reading literacy discussed in the previous section, was socioeconomic status (SES), as determined from parent's occupations classified according to the International Standard Classification of Occupations (ISCO). SES was significantly related to achievement in all three domains. An interesting perspective on the relationships of SES and achievement is provided in Chapter 7, where the results found in Australia are discussed in the context of the relationships found in several other countries that took part in PISA. Other variables, such as family wealth, parents' education level and extent of educational resources at home were also correlated with achievement, as expected. Taking differences in the students' home backgrounds into account, some of the state and territory differences in achievement appear likely to be due to state and territory differences in the students' socioeconomic backgrounds (significant differences between some of the states and territories in the average SES of participating PISA students were found).

All contextual variables that showed significant relationships with achievement when considered in bivariate analyses (that is, each variable by itself analysed together with an achievement measure) were included in multivariate analyses (that is, many variables analysed simultaneously together with an achievement measure) to assess the relative importance of the variables in explaining differences in achievement (in a statistical sense).[2] The results of these analyses are presented in Chapter 8. The perspective from these analyses is important, in that the component of variance in achievement attributable to each variable is quantified after taking the contributions of all the other variables into account.

As expected from the findings of other research, differences in student background variables, especially socioeconomic status based on parents' occupations, were dominant in relation to achievement differences. Over and above the statistical effects of the student background variables, however, some variables pertaining to students' attitudes and some school-related factors were found to contribute significantly to explaining differences in achievement.

With respect to students' attitudes, enjoyment of reading, perceived comfort with computers, determination to do well and confidence in their own ability all contributed significantly in relation to the students' reading literacy achievement. Interest in and perceived comfort in using computers, determination to do well, use of all three kinds of learning strategies (control, elaboration and memorisation), and confidence in their own ability to do well all showed significant relationships, over and above SES, with achievement in mathematical literacy. The same set of factors, apart from use of memorisation strategies and confidence in ability to do well, were useful in explaining differences in scientific literacy achievement

School-related variables that contributed significantly to relationships with achievement were also dominated by socioeconomic status, this time determined at school level by averaging the SES of students at the school. School enrolment size played a small role in accounting for achievement differences, with larger schools

[2] In social science literature, it is common for terms such as 'explaining variance', 'accounting for variance' and 'the relative effects of variables' to be used when discussing multivariate and multilevel analyses. Use of these terms in such contexts indicates whether the variables are associated, and, if so, the extent to which they are associated.

tending to achieve better results. The same was found internationally, up to schools with enrolments of 1000. Beyond that point, the relationship with achievement was barely discernible. The amount of instructional time spent in science contributed significantly to accounting for achievement differences in scientific literacy in Australia, possibly because of greater variation across Australia in the time that students spend in science lessons than in mathematics or English lessons.

Some classroom-related variables, which in PISA could only be measured at school level because there was no teacher questionnaire, were also found to be of use in accounting for achievement differences. A positive disciplinary climate had a significant relationship with achievement in all three domains, over and above the effects of all other variables. The extent of support offered to students by their teachers, as perceived by the students, played a significant and positive role in explaining variance in achievement in both reading and mathematical literacy, though not in scientific literacy. *Achievement press*, that is, the level of pressure teachers place on students to work hard, had a significant and positive relationship with scientific literacy results, while teacher morale, as rated by principals, contributed in a positive way to the explanation of achievement differences in all three domains.

>> *Policy issues*

Several of the PISA results have important policy implications. Some factors related to achievement can be directly influenced by education systems or schools, such as the provision of resources for instruction, but other factors, such as students' social background, cannot directly be influenced by schools. However, it is possible to introduce policies to ameliorate the effects of disadvantage, which Australia already does to some extent through programs that provide more money and resources to schools in needy areas. PISA did not examine funding as such, but included measures of teacher shortage and adequacy of resources. Education systems strive to provide equal opportunities in schooling for all Australian students. The PISA data can indicate how well we are succeeding in this respect in comparison with other countries.

It is well known that students from different backgrounds do not perform equally well. PISA data are able to identify the extent to which differential performance is likely to be due to home influences and the extent to which it is likely to be due to conditions and experiences at school. In some PISA countries, differences in students' performances between schools were found to account for as much as 60 per cent of the variation in achievement. This was not the case in Australia, where only 17 per cent of the variation in achievement was explained (in a statistical sense) by school factors. Australia's schools are more homogeneous in terms of outcomes than schools in more than half the countries that took part in PISA. If a goal is to achieve further equality of outcomes, the Scandinavian countries provide a benchmark of what can be done. In Norway, Finland, Sweden and Iceland, the percentage of variation in achievement due to schools was 10 per cent or less.

Achievement differences in Australia are much larger within schools than they are between schools. The discussion of PISA findings in relation to students' socioeconomic status in Chapter 7 implies that the impact of schooling on performance is greatest for students from disadvantaged backgrounds. It is probably easier to provide targeted funding at school level than at student level, but schools could be encouraged to implement supplementary programs to improve the skills of students who are struggling, many of whom will have come from disadvantaged backgrounds. Many schools already do this, of course.

The analyses in Chapter 9 show that many aspects of disadvantage tend to go together, resulting in students with low motivation, low interest in reading, never bothering to read books, and so on. The challenge is to provide programs that are interesting and stimulating, to help students begin to like reading and want to engage in reading more than they currently do. Internationally, Australia did not have the highest percentage of students who said they never read for enjoyment (Japan was highest, at 52 per cent; Australia's percentage was 33), but we had the highest difference in reading achievement of any country between the students who never read for enjoyment and those who read for one or two hours a day. The difference was 92 scale points, almost equal to one standard deviation on the scale and equivalent to more than one proficiency level.

The PISA results in reading reinforce current concerns about the achievement of boys compared with girls. In every country, girls significantly outperformed boys in reading, as we have seen from the data presented in this report. Boys are substantially over-represented at the lowest proficiency levels and under-represented at the highest level in Australia. To raise Australia's achievement in reading, raising the performance of boys will be just as important as raising the performance of students from disadvantaged backgrounds. There is, unfortunately, nothing new in this statement, but what PISA can do is document the situation from analyses of a uniquely high quality and nationally representative data set.

Concerns about Australian students' reading levels can also be informed in finer detail by the PISA data. Analyses of reading performance by state and territory showed boys being outperformed by girls in every jurisdiction, but the differences were found to be twice as high in Queensland and Tasmania as in some of the other states. Policies to raise boys' performance are urgently needed everywhere, but the need appears to be even more urgent in these two states.

PISA data also revealed that Australians cope better with what are referred to as 'non-continuous' texts than they do with 'continuous' texts. Examples of non-continuous texts are schematic diagrams, application forms, workplace instructions, maps and timetables. The main examples of continuous text (sometimes referred to as 'prose') are narratives, but argumentative and expository texts also belong in this category. It is a value judgement whether critical and reflective skills that relate more to literary texts than other types of text are important for Australia's citizens to have, in addition to the skills needed to find and process information in documents and so on. In these times when fragmented text is proliferating at a very rapid rate, through advertising, news headlines and Short Message Service (SMS) messages, skills associated with literary texts are likely to decrease quickly in our society unless schools place more emphasis on them in their formal timetables.

There are two further points arising from PISA that lend support to the above argument about the need for more emphasis on literary texts in school curricula. The first point is that boys' performance was particularly poor on assessment items associated with continuous text. Boys do not read for pleasure as much as girls do, and boys also show a lesser engagement in reading in other ways as well, such as in their reading preferences. The second point is rather obvious from the sample student responses included in Chapters 3 and 4. Errors in spelling and grammar were not penalised in PISA – if they had been, probably all countries' achievement levels would have gone down, but there is no doubt that Australia's would have. It was the exception rather than the rule in Australia to find a student response that was written in well-constructed sentences, with no spelling or grammatical error.

While the highest-performing Australian students achieved on a par with the highest achievers anywhere, the analyses presented in Chapter 7 show that Australia has a long way to go compared with some other countries in compensating for socioeconomic disadvantage. The OECD considers that the most successful countries are those whose students achieve at a high level regardless of their socioeconomic background. The two most successful countries in this respect are Korea and Finland, both of which have high and relatively flat social gradients for reading performance, and also for mathematics and science performance. These countries are doing something to help their less advantaged students to achieve at a level that is almost as high as the level reached by their more advantaged classmates. The data provide a possible clue in that very high percentages of students in these two countries (as well as in Japan) attend extra classes beyond normal school hours.

Australia's social gradient in mathematical literacy is flatter than our social gradient for reading, though still noticeably steeper than those of Korea, Finland and Canada (see Figure 7.5). It is also noticeably flatter than the gradients for mathematics of the United Kingdom and the United States. It appears that we have achieved some relative success in progress towards equity of outcomes in mathematics. While there was no significant difference for boys and girls overall in mathematics achievement, the boys performed much better in mathematics than in reading and are over-represented among the highest performers (though equally represented in the group of lowest performers). A further finding for mathematics is that the performance of students whose schools are in a remote area was not significantly different from the performance of students from less remote areas.

The low achievement of Indigenous students continues to be a concern, but PISA provides some perspectives that are otherwise not available. As reported above, the Australian Indigenous students, as a group, performed at an equivalent level to students from some of the OECD countries. Some individual Indigenous students performed very well on the PISA tests, and 40 per cent of the group achieved at least proficiency Level 3 in reading. The Indigenous students as a group will continue to need extra support in raising the students' achievement levels, but the PISA results suggest that progress is being made. The challenge will be to ensure that it continues to be made.

Strengths and weaknesses in reading literacy revealed by PISA in Australia have been mentioned above. The PISA data also suggest some areas of mathematics and science which could receive more attention, if they are considered to be important. In mathematics, performance was stronger on items from the area of 'growth and change' than it was on items from 'space and shape'. Similar findings were obtained in TIMSS, where geometry was Australia's weakest strand. Our students performed better in PISA on statistics and functions items than on algebra and measurement items. Whether curriculum policies are changed or not will depend on the relative value placed by mathematics educators on skills in these various areas.

In science, there were compensating gender differences in Australia on items assessing understanding of scientific investigations, on which girls performed better, and on items assessing conceptual understanding, on which boys performed better. It is likely that differences in performance in scientific literacy in PISA were confounded with differences in reading skills, as there was a moderate to high verbal loading in the PISA science tasks. At this point, rather than suggesting any implication for science curricula, it would be preferable for PISA to reduce the verbal loading of its science items for future cycles, especially in 2006 when science will be the major domain. This needs to be done to ensure that students' scientific skills rather than a mixture of reading and scientific skills are measured.

In terms of school resources, none of the measures of resources used in PISA was related to achievement in Australia when considered together with other factors in multilevel analyses. It has already been pointed out that a much greater proportion of the variance in student achievement in Australia is due to within school factors rather than to differences between schools. Thus, it is more difficult in Australia to identify school-level factors that 'make a difference' than it is in countries where a relatively large proportion of the differences in achievement is related to differences between schools.

Even though the amount of homework done by Australian students each week in English, mathematics and science was measured at student level, this variable provides a good indication of school policy and was considered to be a school-related variable rather than a student-related variable. Higher amounts of homework done were associated with higher achievement. The PISA results indicate that schools and parents should be encouraging students to do their homework as a way of enhancing the students' achievement.

Apart from amount of homework, the most important school-level factors in Australia were found to be teacher morale (as perceived by principals), and disciplinary climate and teacher support (as perceived by students). Higher teacher morale, a more positive disciplinary climate and greater amounts of support offered by teachers to their students were all associated with higher levels of achievement in more than one domain. These are all factors that education systems and schools can do something about. Some are aspects of pedagogy, and suggest that it might be important to provide teachers with opportunities for refresher courses or other forms of professional development to help them keep their skills up-to-date. Allowing a little time away from the classroom would introduce an element of variety, and could help teachers maintain their enthusiasm and morale in both their own interests and the interests of their students.

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Appendix **ONE**

PISA'S PROCEDURES

To assist readers to understand the scope and operations of PISA, a brief account of some of its procedures is provided in this Appendix. A thorough account will be available early in 2002 in the Technical Report of the project. Most of the operational procedures have both international and national components. Information on how PISA operated internationally in building up to and implementing the first assessment in 2000 is given first, followed by details of its implementation in Australia.

>> *PISA internationally*

International consortium

PISA 2000 was implemented through an international consortium managed by the Australian Council for Educational Research (ACER). Other members are The Netherlands National Institute for Educational Measurement (CITO), the Educational Testing Service (ETS) and Westat Inc. of the United States, and the National Institute for Educational Research (NIER) in Japan. The same consortium is also implementing PISA 2003.

Collaborative development

PISA is an international assessment that has been jointly developed by the OECD's participating countries. Through their National Project Managers and National Advisory Committees, countries have been able to contribute to the survey by providing sample assessment material to the consortium and offering comment on many aspects of the project to the international bodies described below – Network A, the Board of Participating Countries and Functional Expert Groups.

The OECD has set up several networks to undertake specific tasks relating to PISA. Network A focuses on educational outcomes and is responsible for the 'Education at a Glance' project. Network A's work during the mid-1990s led to the development of the initial specifications for PISA.

Each OECD country taking part in PISA has one member, mostly from an education ministry, as a representative on the Board of Participating Countries (BPC). This group sets the policy objectives of the assessment and the policy priorities for the implementation of the survey. This includes endorsing the assessment frameworks, approving the bank of items developed for the assessment and agreeing to the plans for international reporting of results. The BPC also considers advice from the PISA Technical Advisory Group (TAG) on technical aspects of design, for example concerning the balance of multiple choice and open-ended items, the number of assessment booklets and the design for rotation of material in the assessment booklets. Aspects such as these require the BPC's endorsement.

The three Functional Expert Groups (FEGs) for PISA 2000 consisted of subject matter and technical experts from participating countries. Each assessment domain – that is, each of reading, mathematical and scientific literacy – had its own FEG. These groups, together with the TAG, linked the policy objectives as specified by the BPC with expertise in the field of international comparative assessment, to provide input into the frameworks for the assessment and to monitor the quality of assessment items prepared. The expert groups typically contain from eight to ten members each. The members are not intended to represent countries as such, but rather to provide a cross-section of the world's most renowned experts in each area. A smaller group of consultants assisted with the PISA 2000 questionnaire development. All of these groups provide advice and recommendations to the consortium, and, through the consortium, to the BPC.

Operational stages

Very high standards are set for sampling, assessment materials and operational procedures in PISA to ensure that the data will be comparable across countries. Many of the operational steps are briefly referred to here. More detail is provided later on how the various procedures worked in Australia.

Framework and item review

All components of PISA's assessment framework were circulated for comment several times, with the aim of reaching consensus on the nature and detail of the assessment domains. Similarly, drafts of assessment items were sent to each country, for review by local experts. Countries had the opportunity to provide feedback and suggestions on the items, which were then revised and subjected to a Field Trial.

The Field Trial was an instrumental part of the study, not only to refine the assessment materials but also to try out the operational procedures. Internationally, many thousands of students took part, including over 1100 from Australia. Nine assessment booklets were used, as practice for the Main Study, and there were three questionnaire forms in order to achieve a greater coverage of material than would be possible in one form. The Field Trial took place from March to June 1999.

Main Study

The PISA Main Study was administered between March and May 2000 in Northern Hemisphere countries, and between July and October in Australia, Brazil and New Zealand. Within each country between 4000 and 9500 students were tested, except in Canada which had a larger sample in order to combine PISA with another national study. Details of the Field Trial and Main Study in Australia are provided later in the appendix. The remainder of this section describes some of the more technical features of PISA's assessment design.

Design aspects

Assessment booklets

PISA 2000, a pen-and-paper-based assessment, was prepared in booklet style. Both 'closed' and 'open-ended' assessment items were used. Closed items have only one correct answer and open-ended items require students to construct their own response. Open-ended items allow a wider range of skills to be assessed.

Each PISA assessment task takes the form of some stimulus material followed by a series of questions (items) relating to the material. The stimulus material and its associated items are called a 'unit'. For both the Field Trial and the Main Study, each unit in the pool is allocated to a test cluster. The clusters typically contain about four units and are designed to take 30 minutes to complete. In PISA 2000 there were nine reading clusters, four mathematics clusters and four science clusters. The clusters were allocated in a rotated design to nine assessment booklets, with four clusters making up each booklet.

Use of such a design allows a large amount of material to be covered, with different students completing different combinations of the items. The booklets were allocated to students in turn, from a random starting point in each school.

Questionnaires

As well as the assessment booklets, there were two context questionnaires. Principals each completed a School Questionnaire and students each completed a Student Questionnaire. These were designed to enable analysis of achievement data in relation to different backgrounds, living conditions, educational programs and other factors that might have an impact on performance.

As well as assessing home and academic environments, the Student Questionnaires also included optional sections to assess Familiarity with Information Technology and some generic skills collectively referred to as Cross-Curriculum Competencies (CCCs). The CCCs are skills that should facilitate learning in any area throughout life. In 2000, for those countries undertaking these international options, the CCCs focused on 'self-regulated' learning. These optional components were placed at the end of the Student Questionnaire. There was also an opportunity for countries to include additional items of national interest.

Ensuring a high quality assessment

Quality monitoring is an integral part of PISA, and the implementation of checking procedures within all components and stages of the survey have ensured that PISA has produced data of a very high standard. As outlined below, members of the consortium developed the quality monitoring procedures, which were submitted to the BPC for review and endorsement.

The lead member of the consortium, ACER, set up an International Project Centre (IPC) to manage the implementation of PISA internationally. Staff of the IPC were always available to give advice to countries as requested. They continuously monitored countries' progress and were proactive in offering assistance with procedures if this seemed to be warranted.

Translation procedures

Experts in translation procedures were appointed to ensure that translated materials were as equivalent in meaning and level of complexity as possible. Translation of the assessment booklets, questionnaires and manuals involved extensive and thorough processes. Materials from the IPC were provided to countries in both English and French. In countries where the language is neither English nor French, the countries were required to translate the assessment materials separately from both versions. A reconciliation of these independent translations then took place at country level and the resulting translation was then reviewed by the team of tri-lingual verifiers working for the IPC.

Sampling procedures

Ensuring the quality of sampling in PISA was the responsibility of Westat, which appointed one of its senior staff members to be the International Sampling Referee for the project. A team of sampling experts at Westat developed rigorous procedures for the random selection of schools and students to represent their country. Countries' sampling plans had to be submitted for approval by Westat staff before any sampling was done. Stringent criteria for adequate response rates were specified at the school and student level. Participating countries agreed to meet the international criteria for response rates; otherwise their data could not be included fully in reports. The sampling procedures helped to ensure that the data would be of a high standard, so that valid comparisons of results between countries could be made.

Test administration procedures

Criteria for Test Administrators were set internationally. It was required that the Test Administrator not be the reading, mathematics, or science instructor of any students in the sessions he or she would be administering. It was further recommended that the Test Administrator not be a member of the staff of any school where he or she would be administering PISA, or of any school in the PISA sample. These criteria were set partly to minimise the burden on schools, but mostly to establish PISA as a valid and unbiased assessment with uniformly administered test sessions.

Standardised administration procedures were developed by the consortium and were brought together in a Test Administrator's Manual. Comprehensive training sessions were held in the administration procedures, both for the Field Trial and again for the Main Study. Training sessions were held firstly for National Project Managers (NPMs) or their designated staff, who were then responsible for training the Test Administrators in their country. In that way it was hoped that standardised administration of the PISA tests could be achieved.

Monitoring of procedures

The IPC set up a two-stage process of monitoring the implementation of PISA in each country. Prior to the Field Trial, the national centres responsible for implementing PISA were visited by National Centre Quality Monitors (NCQMs), one per country. The NCQMs were drawn from staff of the various consortium members. They travelled to each of the PISA countries to ensure that procedures were being followed correctly in national centres and to offer assistance if this seemed needed. Some countries were also visited in a similar way prior to the Main Study.

A second kind of monitor was used during the Main Study. These monitors, known as PISA Quality Monitors (PQMs), were nominated by national project teams but were not allowed to be connected in any way to a National Centre. PQMs were used to observe testing sessions to ensure that the testing procedures were being implemented according to the specifications in the Test Administrator's Manual. They were trained nationally in PISA's procedures by the visiting NCQM (see above) and then went to a subset of schools, unannounced, during the assessment sessions. Worldwide, PQMs attended about 300 assessment sessions for the Field Trial and about 1200 such sessions for the Main Study.

Marking of responses to open-ended items

Almost half of the PISA 2000 reading items and about a third of the mathematics and science items were open-ended, necessitating judgement marking. Standardised Marking Guides were developed by consortium staff but were reviewed by PISA national project staff before being finalised. In countries where languages other than English or French were used, these Guides had to be translated and the translations verified by the consortium (double translations were not required, however). The same approach to training markers was used as for Test Administrators, in that NPMs or their designated staff first attended international training sessions and then trained the markers in their country.

Reliability studies were carried out to ensure that markers were applying the criteria consistently, and to quantify any variation between markers. Monitoring of consistency in applying the marking criteria was required to be done on a daily basis so that systematic errors could be corrected. In the Main Study, four markers in each country were required to mark all of the items in their subject area from 48 randomly selected booklets. A cross-national study of marker reliability was also undertaken. The 48 booklets that had already been marked four times within a country were sent to be marked a fifth time by an experienced marker in another same-language country. These data were collected for information only, as a gauge of the success of the marking procedures and Guides.

Data entry procedures

Another step in ensuring the high quality of PISA data was the provision to countries of specially developed software for entering and validating data. It was important that data were submitted to the IPC in a standard format so that they could readily be combined into a single international data set. Many data cleaning procedures were carried out before the data were considered to be ready for analysis.

>> *PISA nationally*

Project management

A National Project Manager (NPM) is appointed by each participating country to ensure that the survey is implemented according to the international timeline and that all duties are carried out according to the specified procedures and standards. NPMs play a role in evaluating the survey results in a national context and a large role in ensuring the operational success of the survey in their country. Countries are encouraged by the OECD to set up one or more committees, to monitor the progress of the project, to assist with reviewing materials and to provide a forum for discussion of issues of implementation at the national level. In Australia, a National Advisory Committee (NAC) was formed to guide all aspects of the project. The Committee's members are from many areas of Australian education and include subject matter experts to advise the NPM and the national BPC representative on the content and methods of the assessment. Each of the state and territory Education Departments has a representative on the NAC.

The Committee's involvement in policy decisions relating to international and national options, commenting on frameworks, and providing input into assessment materials and dissemination of results, ensures that any issues of concern in Australia are not overlooked by the consortium. Members are listed at the front of this book, immediately prior to the first chapter.

Item review

Members of the NAC and a specially convened group, the Indigenous Education Consultative Group, reviewed items for their relevance and appropriateness for Australian 15-year-old students. A few items were adapted to help ensure that Indigenous students would not be confronted with unfamiliar vocabulary.

Field Trial

In Australia, the Field Trial took place during mid-May to mid-June 1999. A summary of its scope is presented here.

Schools

It was permitted in the Field Trial to use a representative sample of schools based on judgement rather than on random selection. The 45 Australian schools approached to take part were selected from the three largest states – New South Wales, Victoria and Queensland – taking care to include schools from a range of communities and socioeconomic areas. The number of schools within a state was selected in proportion to the ratio of Year 10 enrolments in government to Catholic to independent schools. Although 42 schools, including a few replacement schools, agreed to participate in the trial, two of them were unable to find a suitable time for testing because of mid-year exams. The actual school response rate for first selected schools (80 per cent) was below the international requirement of 85 per cent. This illustrated the commitment that would be necessary to guarantee that Australia's response rate would meet the international criteria in the Main Study (see Appendix 2).

Students

The target population for the field trial was 'all students born in 1983'. It was decided by the TAG that the least error-prone way to obtain lists of students from schools for sampling purposes would be to ask for all students born within a calendar year to be identified. Thirty-five students from each school were then randomly selected by ACER staff according to procedures specified in the international sampling manual. Of the 1369 age-eligible students selected, 1127 completed an assessment booklet and 1125 completed a Student Questionnaire. The response rate of students within schools was 82 per cent, satisfying the international requirement of 80 per cent.

Adaptations to manuals, assessment booklets and questionnaires

Minimal adaptations for Australia were required to the administrative manuals, Marking Guides, assessment booklets and questionnaires. Amendments to assessment booklets such as vocabulary and changes to students' names used in assessment items (for example, 'Jouni' was changed to 'Tony') were submitted to and approved for use by the IPC.

Test administration

Each student was asked to complete an assessment booklet (consisting of multiple-choice and open-ended items) and a questionnaire. All but one test session took place in a single morning. Two hours plus administration time were required for the assessment booklet and about 30 minutes was required for the questionnaire. There was provision for a short break to be taken after students had worked on their assessment booklet for an hour, and a break of 10 to 20 minutes to be taken before starting the questionnaire. Seven experienced teachers were employed by ACER to conduct the Field Trial sessions. Seven supplementary sessions were held to improve the student response rate. Training of test administrators took place at ACER in early May 1999.

Marking

Almost half of the field trial items were open-ended and required markers to code the students' responses. Training in the marking procedures and internationally prepared Marking Guides was conducted during June, with four mathematics/ science markers and seven reading markers used, as recommended by the IPC. The marking process also included multiple marking of approximately one-third of the items, as specified internationally.

Data entry

All data were entered using KeyQuest, the specially developed software provided to national centres by the IPC.

Main Study

Assessment dates in Australia

In Australia, the Main Study assessment took place from the third week of July until the end of August 2000, with slight variations between states due to holiday dates and some students' work experience commitments.

Schools and students

Full details of the Australian school and student samples are presented in Appendix 2, and hence are not included here. Australia satisfied the international response rate criteria fully, with 231 of 246 schools and over 83 per cent of the selected students taking part.

Obtaining the school sample

Permission was sought from state and territory Education Departments and Catholic Education Offices to approach the schools that had been randomly selected to participate in PISA. The Associations of Independent Schools in each state and territory were also notified of the selected main and replacement sample schools. In most states, letters endorsing the value of PISA were sent from the Education Department to the selected government schools, recommending that they take part in the study.

Schools were mostly approached from late February to early March by letter, with an accompanying information package about PISA. An exception was schools in New South Wales, which were not approached until early May because of industrial action by teachers earlier in the year. Many schools responded quickly but others typically required several follow-up phone calls before their participation was confirmed.

Response rates and the sampling of students are discussed in Appendix 2.

Contact persons in schools

Participating schools were asked to nominate an experienced staff member to take on the role of PISA School Coordinator. School Coordinators assisted by making administrative arrangements for the assessment session in their school – for example, setting the date for the session, finding a room in which the session could be conducted, arranging for lists of age-eligible students to be sent to the national centre, and so on.

National options

Countries were permitted to introduce additional aspects of national relevance into PISA, subject to approval from the IPC. Australia chose to add two kinds of optional material to the tests and Student Questionnaire, as described in the following paragraphs.

Additional test booklet

In addition to the nine international assessment booklets, Australia included a tenth booklet. This additional booklet contained items from both PISA and the Third International Mathematics and Science Study (TIMSS), and was used to enable links to be made between results from the two studies. This is of particular interest in Australia because the cohort of students assessed in PISA 2000 was the same cohort who were tested in Australia as 9-year-olds in TIMSS in 1994 and as 13-year-olds in the repeat of TIMSS in 1998.

Additional questionnaire items

Since many migrants to Australia come from English speaking countries, information on language spoken at home and on parents' and respondent's countries of birth was sought in the Australian questionnaire. It was felt, for example, that responses to the international format question of 'Were you born in Australia?' (Yes/No) would not be accurate as an indication of ethnic background.

As well as recommending minor adaptations to terminology and vocabulary in the tests, the Indigenous Education Consultative Group also requested the inclusion of additional items in the questionnaires. As a result, national option items were incorporated in the Student Questionnaire. The additional items included Indigenous status, time spent in a range of out-of-school activities, travel time to school, periods of absence from school and students' educational aspirations.

Test Administrators

Twenty-seven Test Administrators external to the schools administered all test sessions. Most were employed by ACER on a casual basis. All were highly experienced, trained teachers, many of whom were also experienced in conducting test sessions according to standardised procedures.

In Victoria, Test Administrators came from ACER's team of casual employees who work as testers on a wide range of projects. In all other states, Education Departments assisted by locating appropriate persons for ACER to use in this role. These were recently retired teachers or teachers on maternity or other temporary leave, all based in capital cities. Many had to travel extensively to cover the non-metropolitan schools in the sample.

In the Australian Capital Territory and the Northern Territory, school authorities decided to have a census of schools containing age-eligible students take part in PISA. In these cases, local departmental staff assisted by carrying out some of the sessions.

All except the Northern Territory Test Administrators were brought to ACER for a one-day training session in early July 2000. Testers in the Northern Territory were trained at a separate session in Darwin, later in the month. The sessions were highly useful – to establish a sense of common purpose among the diverse group of Test Administrators who had mostly not met each other before; to ensure that they were appropriately briefed for conducting the sessions; and to apportion the test sessions and establish travelling schedules in what was a complex, logistical operation. The departmental staff from the Australian Capital Territory and the Northern Territory who conducted some of the test sessions participated in the training.

Scheduling of sessions: logistics

The assessment booklets and questionnaires were usually administered in a single morning. The exceptions were in two schools where the test and questionnaire sessions took place at different times (the student questionnaire was completed in the afternoon in one school and the next day in the other school). The amount of time required was about three hours, arranged the same way as in the Field Trial. A muesli bar snack was provided for each student during the break between the assessment booklet and the questionnaire. Students were allowed to talk to each other during the breaks, though they were asked not to talk about the assessments. Altogether, 233 regular and almost 60 make-up testing sessions took place. Make-up sessions were held within the specified main testing period of six weeks, with a handful of exceptions where sessions were held in early September. Test Administrators also conducted almost all of the make-up sessions. School Coordinators were used in a few schools for make-up sessions where the schools were in remote areas. Sixty per cent of testing sessions were carried out in classrooms, 16 per cent in the school library, 7 per cent in the school hall and 17 per cent in a range of areas such as common or meeting rooms or the computer room.

Marking processes

Seventeen reading markers and eight mathematics/science markers were used, as recommended by the IPC, for the whole duration of the marking. All markers were experienced secondary teachers, not currently teaching. Training of mathematics/science markers in use of the Marking Guide occurred in mid August, two weeks before the end of the testing. Marking of mathematics and science items was begun at this time, as all marking and data entry had to be completed within three months of the end of the testing period. By doing this, it was hoped that some of the booklets would be ready for the reading markers to begin marking by the end of August, when their training session was held. All but one of the nine booklets contained items from more than one domain, which necessitated much passing of booklets among markers.

Following the procedures specified by the IPC, marking was done by clusters, rather than by booklet. Before a new cluster was started, further training and practice on the new clusters was carried out. Within clusters, marking was done by item. The specified procedures for randomly allocating booklets to markers were followed.

'Table leaders' (very experienced markers) were used to field queries from individual markers, to review with individual markers any issues that needed to be drawn to their attention, to document difficulties that needed resolution from the NPM or the IPC and to monitor the marking process generally.

The mathematics/science marking was finished, including the multiple marking, within a month. The reading marking was completed in just under eight weeks. In addition to improved Marking Guides, revised after the Field Trial, the expertise and experience of the table leaders ensured that the work progressed well.

Data entry

Up to seven operators, but usually fewer than this, were used to enter the assessment data from the booklets and the multiple marking sheets, and the questionnaire data. All data were entered in just under one month, using KeyQuest. Checking and cleaning steps, which took a further two weeks, were then undertaken prior to the Australian data being sent to the IPC.

Ensuring quality in national operations

Monitoring of operations and procedures was built into every stage of PISA in Australia, from the selection of the school and student samples, initiating and maintaining contact with schools through to the preparation of materials, printing, packing, mailing, receiving and tallying returns. Other aspects of quality assurance included the detailed training of Test Administrators in the internationally laid-down procedures, the training and monitoring of markers and the entry of data.

PISA Quality Monitors, on behalf of the IPC, visited a sample of 35 Australian schools when the testing was taking place to ensure that procedures were followed accurately and instructions were adhered to.

Appendix **TWO**

SAMPLING

Australian sampling results

Sampling in PISA was carried out in two stages in most countries, including Australia. First, schools were selected with a probability proportional to enrolment size of 15-year-olds. Thus, large schools had a greater chance than small schools of being selected.

Internationally, the minimum required sample for each country was 150 schools and 4 500 students. In Australia, a larger sample was drawn to enable results to be reported by State and Territory. Table A2.1 gives the details of the Australian sample design.

Table A2.1 Designed PISA School Sample by State and Sector

	Sector			
State/Territory	Catholic	Government	Independent	Total
NSW	10	30	5	45
VIC	8	21	6	35
QLD	6	23	6	35
SA	6	19	5	30
WA	6	20	5	31
TAS	4	18	3	25
NT	3	15	3	21
ACT	4	17	3	24
TOTAL	48	163	37	246

Stratification variables used in Australia when selecting the sample were state/territory and sector (government, Catholic and independent).[1] School location, in terms of metropolitan or country, was also taken into account in the sampling. For this purpose, the Australia Post classification of postcodes was used. Following PISA procedures, schools were randomly selected with probability proportional to estimated enrolment size of PISA age-related students within strata, using the latest available data in ACER's sampling frame. To define the PISA population, estimates of the numbers of 15-year-olds were made by sector within each state, from information obtained from the Australian Bureau of Statistics.

Permission was granted from the International Sampling Referee to exclude a number of categories of schools from the sample. Table A2.2 lists the number of excluded schools in each of the categories. These schools catered for a total of approximately about one per cent of the 15 year-old students in Australia. In addition, institutions in the Technical and Further Education (TAFE) sector were also excluded, because there was only 0.7 per cent of 15-year-olds in them.

Table A2.2 Schools Excluded from the Australian PISA Sample – by Category

Exclusion Category	Number of Schools
Schools to year 8 (mostly), but with no or negligible numbers of 15-year-olds*	37
Distance education schools	14
Schools not using Australian curricula	4
Schools on remote off-shore islands	6
Very remote mainland schools	41
Extremely small schools	71

Achieved sample

Main sample

The response rate achieved was sufficiently high to meet the requirements set down by the OECD, although it was necessary to approach some extra schools to replace those schools that declined to be part of the project.

Schools that chose not to participate gave a number of reasons for this. These included those which declared no interest in studies such as this (23 schools); those already involved in a research study this year (four schools); perceived staffing problems (three schools) and in those states where a significant number of 15 year-old students are in Year 11, two schools declined because they didn't want to involve those students in the study.

In all, 232 schools participated in the study although one was later deleted from the sample because a last-minute illness meant that the planned test administration procedures could not be followed. The achieved Australian PISA school sample is included as Table 2.2 in Chapter 2.

The 231 schools represented an unweighted response rate of over 90 per cent. The international standards specified by the OECD required a response rate of at least 85 per cent (weighted) of first selected schools.

1 The stratum codes for sector were necessary for accuracy of sampling. They are not used for reporting purposes in PISA 2000 and are not included in the PISA databases.

The total number of students selected to participate in the survey was 7250. This allowed for thirteen schools which did not have the full complement of 32 eligible students. In these cases, all the age-eligible students at the school were selected. Overall, the participating students constituted an unweighted response rate of 83 per cent, meeting the international requirement of a minimum of 80 per cent of sampled students taking part. The within-school participation ranged from 34 per to 100 per cent (five schools).

Special Indigenous sample

The National Advisory Committee recommended a process of oversampling Indigenous students to reliably report results for this minority group. To achieve this, all age-eligible Indigenous students in the sampled PISA schools were invited to participate in the survey. Approximately 600 additional Indigenous students were identified to take part in the survey in this way, and just over 300 did so.

Absentees

Of the eligible students participating in PISA, 809 students were absent on the day of the testing session. The Australian Capital Territory, South Australia and Western Australia had absentee rates under 10 per cent. The Australian Capital Territory's rate was lowest, at 8.6 per cent, the Northern Territory's highest, at 19.4 per cent. Overall, the absentee rate was 11.2 per cent. The testing took place in mid-winter, when secondary level absentee rates are typically in the eight to ten per cent range.

Students who were absent on the day of the testing are shown by state and system in Table A2.3.

Table A2.3 Absentees and Refusals in Australia by State

	Absentees	Refusals
ACT	63	59
NSW	155	42
VIC	112	48
QLD	134	59
SA	84	71
WA	85	73
TAS	75	14
NT	101	12
TOTAL	809	378

Refusals

In addition to the students who were absent from school, there were 378 whose parents refused permission for them to participate, or they chose to refuse themselves. The tracking form did not distinguish between parent and student refusal. These students constituted 5.2 per cent of the sampled students. The lowest refusal rate was in Tasmania, at just under 2 per cent; and the highest was in

Western Australia with 8.3 per cent, followed by the Australian Capital Territory at 8 per cent. The details are listed in Table A2.3.

Other non-participants

There was also a group of student who were eligible and selected to participate in the survey, but who had left school before the testing, had transferred to another school or temporarily suspended from the school. (The number of not applicable students may have been fewer had some schools provided current school lists of their eligible students).

Exclusions

In all, there were 63 students excluded from the assessment by their schools, with another five students who attempted an assessment booklet but who were also classed as exclusions by the School Coordinator. Exclusions at student level accounted for fewer than one per cent of the designed sample, which is comparable to that obtained in TIMSS and TIMSS-R. Students with exclusions were spread throughout the country.

Exclusion categories used were equivalent to those in the international PISA manual, though with wording changed to reflect current terminology in Australia. The four types of exclusion were:

> **1 = students with a severe physical or sensory disability.** These are students who are permanently physically disabled in such a way that they cannot perform in the PISA testing situation (physically disabled students who can respond to the test should be included in the testing); they are also students with a sensory disability that would prevent them from performing in the PISA testing situation, where for budgetary reasons accommodation strategies are not able to be implemented.
>
> **2 = students with a severe intellectual or emotional disability.** These are students who are considered in the professional opinion of the School Psychologist, School Principal, or other qualified professional to be intellectually disabled or who have been psychologically tested as such. The category also includes students who would be emotionally or mentally unable to follow even the general instructions of the test. **Students should not be excluded solely because of poor academic performance or disciplinary problems.**
>
> **3 = students with limited proficiency in English.** These are students who are virtually unable to read or speak English and would be unable to overcome the language barrier in the test situation. Typically, a student who has received **less than one year of instruction in English** should be excluded. All others should be included.
>
> **4 = students with some other severe disability** (this code should rarely need to be used).

International sampling results

Table A2.4 PISA Target Populations and Samples

COUNTRY	Population and sample information												Coverage indices	
	(1) Total population of 15-year-olds	(2) Total enrolled population of 15-year-olds	(3) Total in national desired target population	(4) School-level exclusions	(5) Total in national desired target population after school exclusions and before within-school exclusions	(6) Percentage of school-level exclusions	(7) Number of participating students	(8) Weighted number of participating students	(9) Number of excluded students	(10) Weighted number of excluded students	(11) Within-school exclusion rate (%)	(12) Overall exclusion rate (%)	(13) Coverage Index 1: Coverage of national desired population	(14) Coverage Index 2: Coverage of national enrolled population
	SF 2[a]	SF 2[b]	SF 3[a]	SF 3[b]	SF 3[c]	3[b] /3[a]		P		E	E / (P+E)		P/(P+E) * (3[c]/3[a])	P/(P+E) * (3[c]/2[b])
OECD Countries														
Australia	266,878	248,908	248,738	2,850	245,888	1.15	5,176	229,152	63	2,688	1.16	2.29	0.98	0.98
Austria	95,041	90,354	90,354	32	90,322	0.04	4,745	71,547	41	500	0.69	0.73	0.99	0.99
Belgium	121,121	119,055	118,972	1,091	117,881	0.92	6,670	110,095	100	1,596	1.43	2.33	0.98	0.98
Canada	403,803	396,423	391,788	2,035	389,990	0.52	29,687	348,481	1,584	16,197	4.44	4.94	0.95	0.94
Czech Republic	134,627	132,508	132,508	2,181	130,327	1.65	5,365	125,639	13	297	0.24	1.88	0.98	0.98
Denmark	53,693	52,161	52,161	345	51,816	0.66	4,235	47,786	119	1,195	2.44	3.08	0.97	0.97
Finland	66,571	66,561	66,319	550	65,769	0.83	4,864	62,826	58	673	1.06	1.88	0.98	0.98
France	788,387	788,387	750,460	17,728	732,732	2.36	4,673	730,494	59	8,208	1.11	3.45	0.97	0.92
Germany	927,473	924,549	924,549	5,423	919,126	0.59	5,073	826,816	60	9,163	1.10	1.68	0.98	0.98
Greece	128,175	124,656	124,187	200	123,987	0.16	3,644	111,363	21	682	0.61	0.77	0.99	0.99
Hungary	120,759	115,325	115,325	0	115,325	0.00	4,887	107,460	34	765	0.71	0.71	0.99	0.99
Iceland	4,062	4,044	4,044	18	4,026	0.45	3,372	3,869	79	79	2.01	2.44	0.98	0.98
Ireland	65,339	64,370	63,572	1,021	62,551	1.61	3,854	56,209	134	1,734	2.99	4.55	0.95	0.94
Italy	584,417	574,864	574,864	775	574,089	0.13	4,984	510,792	117	12,247	2.34	2.47	0.98	0.98
Japan	1,490,000	1,485,269	1,459,296	34,124	1,425,172	2.34	5,256	1,446,596	0	0	0.00	2.34	0.98	0.96
Korea	712,812	602,605	602,605	1,820	600,785	0.30	4,982	579,109	6	826	0.14	0.44	1.00	1.00
Luxembourg	4,556	4,556	4,556	416	4,140	9.13	3,528	4,138	0	0	0.00	9.13	0.91	0.91
Mexico	2,127,504	1,098,605	1,073,317	0	1,073,317	0.00	4,600	960,011	2	564	0.06	0.06	1.00	0.98
New Zealand	54,220	51,464	51,464	976	50,488	1.90	3,667	46,757	137	1,590	3.29	5.12	0.95	0.95
Norway	52,165	51,587	51,474	420	51,054	0.82	4,147	49,579	93	944	1.87	2.67	0.97	0.97
Poland	665,500	643,528	643,528	56,524	587,004	8.78	3,654	542,005	53	5,484	1.00	9.70	0.90	0.90
Portugal	132,325	127,165	127,165	0	127,165	0.00	4,585	99,998	122	2,777	2.70	2.70	0.97	0.97
Spain	462,082	451,685	451,685	2,180	449,505	0.48	6,214	399,055	153	8,998	2.21	2.68	0.97	0.97
Sweden	100,940	100,940	100,940	1,360	99,580	1.35	4,416	94,338	174	3,349	3.43	4.73	0.95	0.95
Switzerland	81,350	79,232	79,232	954	78,278	1.20	6,100	72,010	62	822	1.13	2.32	0.98	0.98
United Kingdom	731,743	705,875	705,875	17,674	688,201	2.50	9,340	643,041	219	15,990	2.43	4.87	0.95	0.95
United States	3,876,000	3,836,000	3,836,000	0	3,836,000	0.00	3,846	3,121,874	211	132,543	4.07	4.07	0.96	0.96
Non-OECD Countries														
Brazil	3,464,330	1,841,843	1,837,236	6,633	1,830,603	0.36	4,893	2,402,280	14	7,842	0.33	0.69	0.99	0.99
Latvia	38,000	35,981	35,981	886	35,095	2.46	3,920	30,063	62	402	1.32	3.75	0.96	0.96
Liechtenstein	415	326	326	0	326	0.00	314	325	2	2	0.61	0.61	0.99	0.99
Russian Federation	2,268,566	2,259,985	2,259,985	10,867	2,249,118	0.48	6,701	1,968,131	22	4,960	0.25	0.73	0.99	0.99
Netherlands[1]	178,924	178,924	178,924	7,800	171,124	4.36	2,503	157,327	1	23	0.01	4.37	0.96	0.96

SOURCE International PISA 2000 Report, Table A3.1

1. Response rate is too low to ensure comparability.

For details see the *PISA 2000 Technical Report* .

Internationally, the desired minimum number of students to be assessed per country was specified as 4500. Some countries, including Australia, sampled more students so that language groups or regions within the country could be adequately represented. In small countries, such as Iceland, Liechtenstein and Luxembourg, the whole cohort of age-eligible students was assessed.

Population coverage

Table A2.4 describes the target population of the countries participating in PISA 2000. Further information on the target population and the implementation of PISA sampling standards can be found in the *PISA 2000 Technical Report*.

- **Column 1** shows the total number of 15-year-olds according to 2000 national population registers.
- **Column 2** shows the number of 15-year-olds enrolled in schools (as defined above), which is referred to as the ***eligible population***.
- **Column 3** shows the national desired target population. As part of the school-level exclusions, countries were allowed to exclude up to 0.5 per cent of students *a priori* from the eligible population, essentially for practical reasons.
- **Column 4** shows the number of students enrolled in schools that were excluded from the national desired target population.
- **Column 5** shows the size of the national desired target population after subtracting the students enrolled in excluded schools. This is obtained by subtracting Column 4 from Column 3.
- **Column 6** shows the percentage of students enrolled in excluded schools. This is obtained by dividing Column 4 by Column 3.
- **Column 7** shows the ***number of students participating in PISA 2000***.
- **Column 8** shows the ***weighted number of participating students***, i.e., the number of students in the nationally defined target population that the PISA sample represents.
- Each country attempted to maximise the coverage of PISA's target population within the sample schools. In the case of each sample school, all eligible students, namely those 15 years of age, regardless of grade, were first listed. Sample students who were to be excluded had still to be included in the sampling documentation, and a list drawn up stating the reason for their exclusion. **Column 9** indicates the number of ***excluded students,*** i.e. students who fell into one of the categories specified above. **Column 10** indicates the ***weighted number of excluded students***, i.e., the overall number of students in the nationally defined target population represented by the number of students excluded from the sample.
- **Column 11** shows the ***percentage of students excluded within schools.*** This is calculated as the weighted number of excluded students (Column 10) divided by the weighted number of excluded and participating students (Column 8 plus Column 10).
- **Column 12** shows the ***overall exclusion rate*** which represents the weighted percentage of the national desired target population excluded from PISA either

through school-level exclusions or through the exclusion of students within schools. It is obtained by multiplying the percentage of school-level exclusions (Column 6) by 100, minus the percentage of students excluded within schools (Column 11) and adding the percentage of students excluded within schools (Column 11) to the result.

- **Column 13** presents an ***index of the extent to which the national desired target population is covered by the PISA sample***. The index is expressed in per cent of the national desired target population covered.
- **Column 14** presents an ***index of the extent to which 15-year-olds enrolled in schools are covered by the PISA sample***. The index measures the overall proportion of the national enrolled population that is covered by the non-excluded portion of the student sample. The index takes into account both school-level and student-level exclusions. Values close to 100 indicate that the PISA sample represents the entire education system as defined for PISA 2000. The index is the weighted number of participating students (Column 9) divided by the weighted number of participating and excluded students (Columns 9 plus Column 11), times the nationally defined target population (Column 5) divided by the national desired target population (times 100).

Sampling procedures and response rates

The accuracy of any survey results depends on the quality of the information on which national samples are based as well as on the sampling procedures. Quality standards, procedures, instruments and verification mechanisms were developed for PISA that ensured that national samples yielded comparable data and that the results could be compared with confidence. Statistics in this report are, however, associated with standard errors that reflect the uncertainty associated with sample survey statistics. Where confidence intervals are provided, these indicate that the true value is, in 95 out of 100 replications of the study, within the interval indicated. Experts from the PISA Consortium monitored the sample selection process in each participating country.

A minimum response rate of 85 per cent was required for the schools initially selected. Where the initial response rate of schools was between 65 and 85 per cent, however, an acceptable school response rate could still be achieved through the use of replacement schools. This procedure brought with it a risk of increased response bias. Participating countries were, therefore, encouraged to persuade as many of the schools in the original sample as possible to participate. Schools with a student participation rate between 25 and 50 per cent were not regarded as participating schools, but data from these schools were included in the database and contributed to the various estimations. Data from schools with a student participation rate of less than 25 per cent were excluded from the database.

PISA 2000 also required a minimum participation rate of 80 per cent of students within participating schools (original sample and replacement). This minimum participation rate had to be met at the national level, not necessarily by each participating school.

Appendix **THREE**

STATISTICAL TABLES

Table A3.1 Multiple Comparisons of Mean Performance on the Total Reading Literacy Scale

Countries	Mean	SE	Finland	Canada	New Zealand	Australia	Ireland	Korea	United Kingdom	Japan	Sweden	Austria	Belgium	Iceland	Norway	France	United States	Denmark	Switzerland	Spain	Czech Republic	Italy	Germany	Liechtenstein	Hungary	Poland	Greece	Portugal	Russian Federation	Latvia	Luxembourg	Mexico	Brazil
	Mean		546	534	529	528	527	525	523	522	516	507	507	507	505	505	504	497	494	493	492	487	484	483	480	479	474	470	462	458	441	422	396
		SE	(2.6)	(1.6)	(2.8)	(3.5)	(3.2)	(2.4)	(2.6)	(5.2)	(2.2)	(2.4)	(3.6)	(1.5)	(2.8)	(2.7)	(7.0)	(2.4)	(4.2)	(2.7)	(2.4)	(2.9)	(2.5)	(4.1)	(4.0)	(4.5)	(5.0)	(4.5)	(4.2)	(5.3)	(1.6)	(3.3)	(3.1)
Finland	546	(2.6)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	534	(1.6)	-1		0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	529	(2.8)	-1	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	528	(3.5)	-1	0	0		0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	527	(3.2)	-1	0	0	0		0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Korea	525	(2.4)	-1	-1	0	0	0		0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	523	(2.6)	-1	-1	0	0	0	0		0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	522	(5.2)	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	516	(2.2)	-1	-1	-1	0	0	0	0	0		0	0	1	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Austria	507	(2.4)	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	507	(3.6)	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	507	(1.5)	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0		0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Norway	505	(2.8)	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
France	505	(2.7)	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	504	(7.0)	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Denmark	497	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1
Switzerland	494	(4.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1
Spain	493	(2.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1
Czech Republic	492	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1
Italy	487	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1
Germany	484	(2.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1
Liechtenstein	483	(4.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	1	1	1	1	1
Hungary	480	(4.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0		0	0	0	1	1	1	1	1
Poland	479	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0		0	0	0	0	1	1	1
Greece	474	(5.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	1	1	1
Portugal	470	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	1	1	1
Russian Federation	462	(4.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	1	1	1
Latvia	458	(5.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	1	1
Luxembourg	441	(1.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		1	1
Mexico	422	(3.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil	396	(3.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE: PISA 2000 International Report Figure 2.4

Above the OECD average | Not statistically significant from the OECD average | Below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is statistically significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance significantly higher than comparison country
0	No statistical difference from comparison country
-1	Average performance significantly lower than comparison country

Table A3.2 Multiple Comparisons of Mean Performance on the Reading: Retrieving Information Sub-scale

Countries	Mean	SE	Finland	Australia	New Zealand	Canada	Korea	Japan	Ireland	United Kingdom	Sweden	France	Belgium	Norway	Austria	Iceland	United States	Switzerland	Denmark	Liechtenstein	Italy	Spain	Germany	Czech Republic	Hungary	Poland	Portugal	Russian Federation	Latvia	Greece	Luxembourg	Mexico	Brazil
	Mean		556	536	535	530	530	526	524	523	516	515	515	505	502	500	499	498	498	492	488	483	483	481	478	475	455	451	451	450	433	402	365
		SE	(2.8)	(3.7)	(2.8)	(1.7)	(2.5)	(5.5)	(3.3)	(2.5)	(2.4)	(3.0)	(3.9)	(2.9)	(2.3)	(1.6)	(7.4)	(4.4)	(2.8)	(4.9)	(3.1)	(3.0)	(2.4)	(2.7)	(4.4)	(5.0)	(4.9)	(4.9)	(5.7)	(5.4)	(1.6)	(3.9)	(3.4)
Finland	556	(2.8)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	536	(3.7)	-1		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	535	(2.8)	-1	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	530	(1.7)	-1	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Korea	530	(2.5)	-1	0	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	526	(5.5)	-1	0	0	0	0		0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	524	(3.3)	-1	0	0	0	0	0		0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	523	(2.5)	-1	0	0	0	0	0	0		0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	516	(2.4)	-1	-1	-1	-1	-1	0	0	0		0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
France	515	(3.0)	-1	-1	-1	-1	-1	0	0	0	0		0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	515	(3.9)	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	1	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Norway	505	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Austria	502	(2.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	500	(1.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	499	(7.4)	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Switzerland	498	(4.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1
Denmark	498	(2.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1
Liechtenstein	492	(4.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1
Italy	488	(3.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1
Spain	483	(3.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0		0	0	0	0	1	1	1	1	1	1	1
Germany	483	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0		0	0	0	1	1	1	1	1	1	1
Czech Republic	481	(2.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0		0	0	1	1	1	1	1	1	1
Hungary	478	(4.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0		0	1	1	1	1	1	1	1
Poland	475	(5.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0		0	1	1	1	1	1	1
Portugal	455	(4.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		0	0	0	1	1	1
Russian Federation	451	(4.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		0	0	0	1	1
Latvia	451	(5.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	1	1	1
Greece	450	(5.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	1	1
Luxembourg	433	(1.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	0	-1	0		1	1
Mexico	402	(3.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil	365	(3.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE; PISA 2000 International Report Table 2.2a

Statistically significantly above the OECD average | Not statistically significantly different from the OECD average | Statistically significantly below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lowerer than in comparison country

Table A3.3 Multiple Comparisons of Mean Performance on the Reading: Interpreting Texts Sub-scale

Countries			Finland	Canada	Australia	Ireland	New Zealand	Korea	Sweden	Japan	Iceland	United Kingdom	Belgium	Austria	France	Norway	United States	Czech Republic	Switzerland	Denmark	Spain	Italy	Germany	Liechtenstein	Poland	Hungary	Greece	Portugal	Russian Federation	Latvia	Luxembourg	Mexico	Brazil
	Mean		555	532	527	526	526	525	522	518	514	514	512	508	506	505	505	500	496	494	491	489	488	484	482	480	475	473	468	459	446	419	400
		SE	(2.9)	(1.6)	(3.5)	(3.3)	(2.7)	(2.3)	(2.1)	(5.0)	(1.4)	(2.5)	(3.2)	(2.4)	(2.7)	(2.8)	(7.1)	(2.4)	(4.2)	(2.4)	(2.6)	(2.6)	(2.5)	(4.5)	(4.3)	(3.8)	(4.5)	(4.3)	(4.0)	(4.9)	(1.6)	(2.9)	(3.0)
Finland	555	(2.9)		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	532	(1.6)	-1		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	527	(3.5)	-1	0		0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	526	(3.3)	-1	0	0		0	0	0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	526	(2.7)	-1	0	0	0		0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Korea	525	(2.3)	-1	0	0	0	0		0	0	1	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	522	(2.1)	-1	-1	0	0	0	0		0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	518	(5.0)	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	514	(1.4)	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	514	(2.5)	-1	-1	0	0	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	512	(3.2)	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Austria	508	(2.4)	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
France	506	(2.7)	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Norway	505	(2.8)	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	505	(7.1)	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Czech Republic	500	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Switzerland	496	(4.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1
Denmark	494	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1
Spain	491	(2.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1
Italy	489	(2.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0		0	0	0	0	0	1	1	1	1	1	1
Germany	488	(2.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1
Liechtenstein	484	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1
Poland	482	(4.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1
Hungary	480	(3.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	-1	0	0	0	0	0		0	0	0	1	1	1	1
Greece	475	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	1	1	1
Portugal	473	(4.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	1	1	1
Russian Federation	468	(4.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	1	1	1
Latvia	459	(4.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	1	1	1	0	0	0		0	1	1
Luxembourg	446	(1.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		1	1
Mexico	419	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil	400	(3.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE: PISA 2000 International Report Table 2.2b

Statistically significantly above the OECD average

Not statistically significantly different from the OECD average

Statistically significantly below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lowerer than in comparison country

Table A3.4 Multiple Comparisons of Mean Performance on the Reading: Reflection and Evaluation Sub-scale

Countries	Mean	SE	Canada	United Kingdom	Ireland	Finland	Japan	New Zealand	Australia	Korea	Austria	Sweden	United States	Norway	Spain	Iceland	Denmark	Belgium	France	Greece	Switzerland	Czech Republic	Italy	Hungary	Portugal	Germany	Poland	Liechtenstein	Latvia	Russian Federation	Mexico	Luxembourg	Brazil
	Mean		542	539	533	533	530	529	526	526	512	510	507	506	506	501	500	497	496	495	488	485	483	481	480	478	477	468	458	455	446	442	417
		SE	(1.6)	(2.5)	(3.1)	(2.7)	(5.4)	(2.9)	(3.4)	(2.6)	(2.7)	(2.3)	(7.1)	(3.0)	(2.8)	(1.3)	(2.6)	(4.3)	(2.9)	(5.6)	(4.8)	(2.6)	(3.1)	(4.3)	(4.5)	(2.9)	(4.7)	(5.7)	(5.9)	(4.0)	(3.7)	(1.9)	(3.3)
Canada	542	(1.6)		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	539	(2.5)	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	533	(3.1)	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Finland	533	(2.7)	0	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	530	(5.4)	0	0	0	0		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	529	(2.9)	-1	0	0	0	0		0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	526	(3.4)	-1	0	0	0	0	0		0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Korea	526	(2.6)	-1	-1	0	0	0	0	0		1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Austria	512	(2.7)	-1	-1	-1	-1	0	-1	-1	-1		0	0	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	510	(2.3)	-1	-1	-1	-1	-1	-1	-1	-1	0		0	0	0	1	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	507	(7.1)	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Norway	506	(3.0)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Spain	506	(2.8)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	501	(1.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Denmark	500	(2.6)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	497	(4.3)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	0	1	1	1	1	1	1
France	496	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	1	0	0	1	1	1	1	1	1	1	1
Greece	495	(5.6)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1
Switzerland	488	(4.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1
Czech Republic	485	(2.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1
Italy	483	(3.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	-1	0	0	0		0	0	0	0	0	1	1	1	1	1
Hungary	481	(4.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1	1
Portugal	480	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	1	1	1	1
Germany	478	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	1	1	1	1
Poland	477	(4.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0		0	0	1	1	1	1
Liechtenstein	468	(5.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	1	1	1
Latvia	458	(5.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	1
Russian Federation	455	(4.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	1
Mexico	446	(3.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	1
Luxembourg	442	(1.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		1
Brazil	417	(3.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE: PISA 2000 International Report Table 2.2c

Statistically significantly above the OECD average | Not statistically significantly different from the OECD average | Statistically significantly below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lowerer than in comparison country

Table A3.5 Variation in Student Performance on the Total Reading Literacy Scale

Country	Mean		Standard deviation		Percentiles											
					5th		10th		25th		75th		90th		95th	
	Mean score	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
OECD Countries																
Australia	528	(3.5)	102	(1.6)	354	(4.8)	394	(4.4)	458	(4.4)	602	(4.6)	656	(4.2)	685	(4.5)
Austria	507	(2.4)	93	(1.6)	341	(5.4)	383	(4.2)	447	(2.8)	573	(3.0)	621	(3.2)	648	(3.7)
Belgium	507	(3.6)	107	(2.4)	308	(10.3)	354	(8.9)	437	(6.6)	587	(2.3)	634	(2.5)	659	(2.4)
Canada	534	(1.6)	95	(1.1)	371	(3.8)	410	(2.4)	472	(2.0)	600	(1.5)	652	(1.9)	681	(2.7)
Czech Republic	492	(2.4)	96	(1.9)	320	(7.9)	368	(4.9)	433	(2.8)	557	(2.9)	610	(3.2)	638	(3.6)
Denmark	497	(2.4)	98	(1.8)	326	(6.2)	367	(5.0)	434	(3.3)	566	(2.7)	617	(2.9)	645	(3.6)
Finland	546	(2.6)	89	(2.6)	390	(5.8)	429	(5.1)	492	(2.9)	608	(2.6)	654	(2.8)	681	(3.4)
France	505	(2.7)	92	(1.7)	344	(6.2)	381	(5.2)	444	(4.5)	570	(2.4)	619	(2.9)	645	(3.7)
Germany	484	(2.5)	111	(1.9)	284	(9.4)	335	(6.3)	417	(4.6)	563	(3.1)	619	(2.8)	650	(3.2)
Greece	474	(5.0)	97	(2.7)	305	(8.2)	342	(8.4)	409	(7.4)	543	(4.5)	595	(5.1)	625	(6.0)
Hungary	480	(4.0)	94	(2.1)	320	(5.6)	354	(5.5)	414	(5.3)	549	(4.5)	598	(4.4)	626	(5.5)
Iceland	507	(1.5)	92	(1.4)	345	(5.0)	383	(3.6)	447	(3.1)	573	(2.2)	621	(3.5)	647	(3.7)
Ireland	527	(3.2)	94	(1.7)	360	(6.3)	401	(6.4)	468	(4.3)	593	(3.6)	641	(4.0)	669	(3.4)
Italy	487	(2.9)	91	(2.7)	331	(8.5)	368	(5.8)	429	(4.1)	552	(3.2)	601	(2.7)	627	(3.1)
Japan	522	(5.2)	86	(3.0)	366	(11.4)	407	(9.8)	471	(7.0)	582	(4.4)	625	(4.6)	650	(4.3)
Korea	525	(2.4)	70	(1.6)	402	(5.2)	433	(4.4)	481	(2.9)	574	(2.6)	608	(2.9)	629	(3.2)
Luxembourg	441	(1.6)	100	(1.5)	267	(5.1)	311	(4.4)	378	(2.8)	513	(2.0)	564	(2.8)	592	(3.5)
Mexico	422	(3.3)	86	(2.1)	284	(4.4)	311	(3.4)	360	(3.6)	482	(4.8)	535	(5.5)	565	(6.3)
New Zealand	529	(2.8)	108	(2.0)	337	(7.4)	382	(5.2)	459	(4.1)	606	(3.0)	661	(4.4)	693	(6.1)
Norway	505	(2.8)	104	(1.7)	320	(5.9)	364	(5.5)	440	(4.5)	579	(2.7)	631	(3.1)	660	(4.6)
Poland	479	(4.5)	100	(3.1)	304	(8.7)	343	(6.8)	414	(5.8)	551	(6.0)	603	(6.6)	631	(6.0)
Portugal	470	(4.5)	97	(1.8)	300	(6.2)	337	(6.2)	403	(6.4)	541	(4.5)	592	(4.2)	620	(3.9)
Spain	493	(2.7)	85	(1.2)	344	(5.8)	379	(5.0)	436	(4.6)	553	(2.6)	597	(2.6)	620	(2.9)
Sweden	516	(2.2)	92	(1.2)	354	(4.5)	392	(4.0)	456	(3.1)	581	(3.1)	630	(2.9)	658	(3.1)
Switzerland	494	(4.3)	102	(2.0)	316	(5.5)	355	(5.8)	426	(5.5)	567	(4.7)	621	(5.5)	651	(5.3)
United Kingdom	523	(2.6)	100	(1.5)	352	(4.9)	391	(4.1)	458	(2.8)	595	(3.5)	651	(4.3)	682	(4.9)
United States	504	(7.1)	105	(2.7)	320	(11.7)	363	(11.4)	436	(8.8)	577	(6.8)	636	(6.5)	669	(6.8)
OECD total	***499***	***(2.0)***	***100***	***(0.8)***	***322***	***(3.4)***	***363***	***(3.3)***	***433***	***(2.5)***	***569***	***(1.6)***	***622***	***(2.0)***	***653***	***(2.1)***
OECD average	***500***	***(0.6)***	***100***	***(0.4)***	***324***	***(1.3)***	***366***	***(1.1)***	***435***	***(1.0)***	***571***	***(0.7)***	***623***	***(0.8)***	***652***	***(0.8)***
Non-OECD Countries																
Brazil	396	(3.1)	86	(1.9)	255	(5.0)	288	(4.5)	339	(3.4)	452	(3.4)	507	(4.2)	539	(5.5)
Latvia	458	(5.3)	102	(2.3)	283	(9.7)	322	(8.2)	390	(6.9)	530	(5.3)	586	(5.8)	617	(6.6)
Liechtenstein	483	(4.1)	96	(3.9)	310	(15.9)	350	(11.8)	419	(9.4)	551	(5.8)	601	(7.1)	626	(8.2)
Russian Federation	462	(4.2)	92	(1.8)	306	(6.9)	340	(5.4)	400	(5.1)	526	(4.5)	579	(4.4)	608	(5.3)

SOURCE: PISA 2000 International Report Table 2.3a

Table A3.6 Multiple Comparisons of Reading Literacy Achievement of the Top Five Per Cent of Students per Country

Country			New Zealand	Australia	United Kingdom	Finland	Canada	Ireland	United States	Norway	Belgium	Sweden	Switzerland	Germany	Japan	Austria	Iceland	Denmark	France	Czech Republic	Poland	Korea	Italy	Hungary	Liechtenstein*	Greece	Portugal	Spain	Latvia*	Russian Referation*	Luxembourg	Mexico	Brazil*
	Mean		693	685	682	681	681	669	669	660	659	658	651	650	650	648	647	645	645	638	631	629	627	626	626	625	620	620	617	608	592	565	539
		SE	6.1	4.5	4.9	3.4	2.7	3.4	6.8	4.6	2.4	3.1	5.3	3.2	4.3	3.7	3.7	3.6	3.7	3.6	6	3.2	3.1	5.5	8.2	6	3.9	2.9	6.6	5.3	3.5	6.3	5.5
New Zealand	693	6.1		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	685	4.5	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	682	4.9	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Finland	681	3.4	0	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	681	2.7	0	0	0	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	669	3.4	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	669	6.8	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Norway	660	4.6	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	659	2.4	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	658	3.1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Switzerland	651	5.3	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1
Germany	650	3.2	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1
Japan	650	4.3	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1
Austria	648	3.7	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1
Iceland	647	3.7	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1
Denmark	645	3.6	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0	0	0	0		0	0	0	1	1	0	0	0	1	1	1	1	1	1	1
France	645	3.7	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0	0	0	0	0		0	0	1	1	0	0	0	1	1	1	1	1	1	1
Czech Republic	638	3.6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	0	1	1	1	1
Poland	631	6.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1
Korea	629	3.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	0	0	1	1	1	1
Italy	627	3.1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	0	1	1	1
Hungary	626	5.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1
Liechtenstein*	626	8.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1
Greece	625	6.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	1	1	1
Portugal	620	3.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	1	1	1
Spain	620	2.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	1	1	1
Latvia*	617	6.6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	1	1	1
Russian Referation*	608	5.3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1	0	0	0	0	0	0	0		0	1	1
Luxembourg	592	3.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		1	1
Mexico	565	6.3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		0
Brazil*	539	5.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	

Note: OECD average = 652

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lower than in comparison country

Table A3.7 Multiple Comparisons of Reading: Retrieving Information Achievement of the Top Five Per Cent of Students per Country

Country			Finland	New Zealand	Australia	Canada	United Kingdom	Belgium	Sweden	Ireland	Japan	United States	Switzerland	France	Norway	Iceland	Denmark	Korea	Liechtenstein*	Germany	Italy	Poland	Austria	Czech Republic	Hungary	Latvia*	Russian Federation*	Spain	Portugal	Greece	Luxembourg	Mexico	Brazil*
	Mean		713	708	704	690	687	685	676	675	674	672	668	668	667	659	657	655	653	652	649	648	648	647	645	633	624	623	621	617	599	570	524
		SE	3.7	6.9	5.5	2.8	4.5	3	3.4	3.9	5.2	7.3	5.8	3.8	4.3	3.6	4.1	3.5	14	3.2	3.7	8.6	3.4	3.5	5.8	6.7	6.5	3.4	4.7	6.2	3.3	7.2	6.6
Finland	713	3.7		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	708	6.9	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	704	5.5	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	690	2.8	-1	0	0		0	0	1	0	0	0	1	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	687	4.5	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	685	3.0	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	676	3.4	-1	-1	-1	-1	0	0		0	0	0	0	0	0	1	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
Ireland	675	3.9	-1	-1	-1	0	0	0	0		0	0	0	0	0	0	1	1	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
Japan	674	5.2	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
United States	672	7.3	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Switzerland	668	5.8	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
France	668	3.8	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1
Norway	667	4.3	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	1	1
Iceland	659	3.6	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1
Denmark	657	4.1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Korea	655	3.5	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Liechtenstein*	653	14.0	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1
Germany	652	3.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1
Italy	649	3.7	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	1	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1
Poland	648	8.6	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1
Austria	648	3.4	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	0	0	0	0	0	0	0		0	0	0	1	1	1	1	1	1	1
Czech Republic	647	3.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	-1	0	0	0	0	0	0	0	0		0	0	0	1	1	1	1	1	1
Hungary	645	5.8	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0	0	0	0	0	0	0	0		0	0	1	1	1	1	1	1
Latvia*	633	6.7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	1	1	1
Russian Federation*	624	6.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	0	0	0		0	0	0	1	1	1
Spain	623	3.4	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	-1	0	0		0	0	1	1	1
Portugal	621	4.7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	-1	0	0	0		0	1	1	1
Greece	617	6.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	-1	-1	-1	0	0	0	0		0	1	1
Luxembourg	599	3.3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0		1	1
Mexico	570	7.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil*	524	6.6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

Note: OECD average = 667

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lower than in comparison country

Table A3.8 Multiple Comparisons of Reading: Interpreting Texts Achievement of the Top Five Per Cent of Students per Country

Country			Finland	New Zealand	Australia	Canada	United Kingdom	Ireland	United States	Sweden	Belgium	Iceland	Norway	Germany	Switzerland	Austria	France	Czech Republic	Denmark	Japan	Poland	Korea	Liechtenstein*	Italy	Hungary	Spain	Portugal	Greece	Russian Federation*	Latvia*	Luxembourg	Mexico	Brazil*
	Mean		701	699	689	682	678	676	672	669	665	664	662	654	653	650	649	649	647	644	633	630	627	625	621	620	617	615	615	611	600	550	543
		SE	2.9	6.7	4.9	2.3	4.8	3.8	7.5	3.4	2.9	4.2	3.5	2.9	5.9	3.7	4.2	4	3.7	4.5	6.5	3	11.1	3	4.9	3	4.5	4.9	4.5	6.2	3.9	5.8	5.1
Finland	701	2.9		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	699	6.7	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	689	4.9	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	682	2.3	-1	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	678	4.8	-1	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	676	3.8	-1	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United States	672	7.5	-1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	669	3.4	-1	-1	-1	-1	0	0	0		0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	665	2.9	-1	-1	-1	-1	0	0	0	0		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	664	4.2	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Norway	662	3.5	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1
Germany	654	2.9	-1	-1	-1	-1	-1	-1	0	-1	0	0	0		0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
Switzerland	653	5.9	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
Austria	650	3.7	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0		0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
France	649	4.2	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
Czech Republic	649	4.0	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0		0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
Denmark	647	3.7	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0	0		0	0	1	0	1	1	1	1	1	1	1	1	1	1
Japan	644	4.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0			0	0	0	1	1	1	1	1	1	1	1	1	1
Poland	633	6.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1
Korea	630	3.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	0	0	0	1	1	1
Liechtenstein*	627	11.1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1
Italy	625	3.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	1	1	1
Hungary	621	4.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	1
Spain	620	3.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	1	1	1
Portugal	617	4.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	1	1
Greece	615	4.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	1	1
Russian Federation*	615	4.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	1	1
Latvia*	611	6.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	1	1
Luxembourg	600	3.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	0	0	0	0		1	1
Mexico	550	5.8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		0
Brazil*	543	5.1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	

Note: OECD average = 656

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lower than in comparison country

Table A3.9 Multiple Comparisons of Reading: Reflection and Evaluation Achievement of the Top Five Per Cent of Students per Country

Country			United Kingdom	New Zealand	Canada	Australia	Japan	Greece	Ireland	United States	Norway	Finland	Austria	Switzerland	Germany	Denmark	Belgium	Sweden	France	Spain	Iceland	Poland	Korea	Czech Republic	Hungary	Italy	Portugal	Latvia*	Liechtenstein*	Mexico	Luxembourg	Russian Federation*	Brazil*
	Mean		695	692	691	683	680	675	671	669	667	665	663	663	662	657	656	654	649	646	645	642	642	641	636	636	634	634	633	624	613	612	569
		SE	4.8	5.6	2.4	5.5	5.8	6.5	3.3	7.6	4.2	3.7	5.3	6.7	3.4	3.6	3	3.7	3.4	4.1	4.1	7	3.9	4.7	5.1	4	4.5	7	13	6.3	3.9	4.8	6.1
United Kingdom	695	4.8		0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	692	5.6	0		0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	691	2.4	0	0		0	0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	683	5.5	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	680	5.8	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Greece	675	6.5	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
Ireland	671	3.3	-1	-1	-1	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	0	1	1	1	1
United States	669	7.6	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1
Norway	667	4.2	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1
Finland	665	3.7	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	0	1	1	1	1
Austria	663	5.3	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	0	1	1	1	1
Switzerland	663	6.7	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1
Germany	662	3.4	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	1	0	1	1	1	1	1	1	0	1	1	1	1
Denmark	657	3.6	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1
Belgium	656	3.0	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1
Sweden	654	3.7	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	0	0	1	1	1	1
France	649	3.4	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1
Spain	646	4.1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1
Iceland	645	4.1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	-1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1
Poland	642	7.0	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1
Korea	642	3.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1
Czech Republic	641	4.7	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1
Hungary	636	5.1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1
Italy	636	4.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	1	1	1
Portugal	634	4.5	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	1	1	1
Latvia*	634	7.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1
Liechtenstein*	633	13.0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	1
Mexico	624	6.3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0		0	0	1
Luxembourg	613	3.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	1
Russian Federation*	612	4.8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		1
Brazil*	569	6.1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

Note: OECD average = 661

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1 Average performance statistically significantly higher than in comparison country

0 No statistically significant difference from comparison country

-1 Average performance statistically significantly lower than in comparison country

Table A3.10 Multiple Comparisons of Mean Performance on the Mathematical Literacy Scale

Countries			Japan	Korea	New Zealand	Finland	Australia	Canada	Switzerland	United Kingdom	Belgium	France	Austria	Denmark	Iceland	Liechtenstein	Sweden	Ireland	Norway	Czech Republic	United States	Germany	Hungary	Russian Federation	Spain	Poland	Latvia	Italy	Portugal	Greece	Luxembourg	Mexico	Brazil
	Mean		557	547	537	536	533	533	529	529	520	517	515	514	514	514	510	503	499	498	493	490	488	478	476	470	463	457	454	447	446	387	334
		SE	(5.5)	(2.8)	(3.1)	(2.1)	(3.5)	(1.4)	(4.4)	(2.5)	(3.9)	(2.7)	(2.5)	(2.4)	(2.3)	(7.0)	(2.5)	(2.7)	(2.8)	(2.8)	(7.6)	(2.5)	(4.0)	(5.5)	(3.1)	(5.5)	(4.5)	(2.9)	(4.1)	(5.6)	(2.0)	(3.4)	(3.7)
Japan	557	(5.5)		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Korea	547	(2.8)	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	537	(3.1)	0	0		0	0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Finland	536	(2.1)	-1	0	0		0	0	0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	533	(3.5)	-1	0	0	0		0	0	0	0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	533	(1.4)	-1	-1	0	0	0		0	0	1	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Switzerland	529	(4.4)	-1	-1	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	529	(2.5)	-1	-1	0	0	0	0	0		0	1	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	520	(3.9)	-1	-1	-1	-1	0	-1	0	0		0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
France	517	(2.7)	-1	-1	-1	-1	-1	-1	0	-1	0		0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Austria	515	(2.5)	-1	-1	-1	-1	-1	-1	0	-1	0	0		0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Denmark	514	(2.4)	-1	-1	-1	-1	-1	-1	0	-1	0	0	0		0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Iceland	514	(2.3)	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0		0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Liechtenstein	514	(7.0)	-1	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	510	(2.5)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	503	(2.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
Norway	499	(2.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1
Czech Republic	498	(2.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0		0	0	0	0	1	1	1	1	1	1	1	1	1
United States	493	(7.6)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1
Germany	490	(2.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	1	1	1	1	1	1	1	1	1
Hungary	488	(4.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	1	1	1	1	1	1	1
Russian Federation	478	(5.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	1	1	1	1	1	1
Spain	476	(3.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0		0	0	1	1	1	1	1	1
Poland	470	(5.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0		0	0	0	0	1	1	1
Latvia	463	(4.5)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	1	1	1
Italy	457	(2.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	1	1	1
Portugal	454	(4.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	1	1
Greece	447	(5.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	1	1
Luxembourg	446	(2.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		1	1
Mexico	387	(3.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil	334	(3.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE: PISA 2000 International Report Figure 3.2

Statistically significantly above the OECD average

Not statistically significantly different from the OECD average

Statistically significantly below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is statistically significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lowerer than in comparison country

Table A3.11 Variation in Student Performance on the Mathematical Literacy Scale

Country	Mean		Standard deviation		Percentiles											
					5th		10th		25th		75th		90th		95th	
	Mean score	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
OECD Countries																
Australia	533	(3.5)	90	(1.6)	380	(6.4)	418	(6.4)	474	(4.4)	594	(4.5)	647	(5.7)	679	(5.8)
Austria	515	(2.5)	92	(1.7)	355	(5.3)	392	(4.6)	455	(3.5)	581	(3.8)	631	(3.6)	661	(5.2)
Belgium	520	(3.9)	106	(2.9)	322	(11.0)	367	(8.6)	453	(6.5)	597	(3.0)	646	(3.9)	672	(3.5)
Canada	533	(1.4)	85	(1.1)	390	(3.2)	423	(2.5)	477	(2.0)	592	(1.7)	640	(1.9)	668	(2.6)
Czech Republic	498	(2.8)	96	(1.9)	335	(5.4)	372	(4.2)	433	(4.1)	564	(3.9)	623	(4.8)	655	(5.6)
Denmark	514	(2.4)	87	(1.7)	366	(6.1)	401	(5.1)	458	(3.1)	575	(3.1)	621	(3.7)	649	(4.6)
Finland	536	(2.2)	80	(1.4)	400	(6.5)	433	(3.6)	484	(4.1)	592	(2.5)	637	(3.2)	664	(3.5)
France	517	(2.7)	89	(1.9)	364	(6.4)	399	(5.4)	457	(4.7)	581	(3.1)	629	(3.2)	656	(4.6)
Germany	490	(2.5)	103	(2.4)	311	(7.9)	349	(6.9)	423	(3.9)	563	(2.7)	619	(3.6)	649	(3.9)
Greece	447	(5.6)	108	(2.9)	260	(9.0)	303	(8.1)	375	(8.1)	524	(6.7)	586	(7.8)	617	(8.6)
Hungary	488	(4.0)	98	(2.4)	327	(7.1)	360	(5.7)	419	(4.8)	558	(5.2)	615	(6.4)	648	(6.9)
Iceland	514	(2.3)	85	(1.4)	372	(5.7)	407	(4.7)	459	(3.5)	572	(3.0)	622	(3.1)	649	(5.5)
Ireland	503	(2.7)	84	(1.8)	357	(6.4)	394	(4.7)	449	(4.1)	561	(3.6)	606	(4.3)	630	(5.0)
Italy	457	(2.9)	90	(2.4)	301	(8.4)	338	(5.5)	398	(3.5)	520	(3.5)	570	(4.4)	600	(6.1)
Japan	557	(5.5)	87	(3.1)	402	(11.2)	440	(9.1)	504	(7.4)	617	(5.2)	662	(4.9)	688	(6.1)
Korea	547	(2.8)	84	(2.0)	400	(6.1)	438	(5.0)	493	(4.2)	606	(3.4)	650	(4.3)	676	(5.3)
Luxembourg	446	(2.0)	93	(1.8)	281	(7.4)	328	(4.2)	390	(3.8)	509	(3.4)	559	(3.2)	588	(3.9)
Mexico	387	(3.4)	83	(1.9)	254	(5.5)	281	(3.6)	329	(4.1)	445	(5.2)	496	(5.6)	527	(6.6)
New Zealand	537	(3.1)	99	(1.9)	364	(6.1)	405	(5.4)	472	(3.9)	607	(4.0)	659	(4.2)	689	(5.2)
Norway	499	(2.8)	92	(1.7)	340	(7.0)	379	(5.2)	439	(4.0)	565	(3.9)	613	(4.5)	643	(4.5)
Poland	470	(5.5)	103	(3.8)	296	(12.2)	335	(9.2)	402	(7.0)	542	(6.8)	599	(7.7)	632	(8.5)
Portugal	454	(4.1)	91	(1.8)	297	(7.3)	332	(6.1)	392	(5.7)	520	(4.3)	570	(4.3)	596	(5.0)
Spain	476	(3.1)	91	(1.5)	323	(5.8)	358	(4.3)	416	(5.3)	540	(4.0)	592	(3.9)	621	(3.1)
Sweden	510	(2.5)	93	(1.6)	347	(5.8)	386	(4.0)	450	(3.3)	574	(2.6)	626	(3.3)	656	(5.5)
Switzerland	529	(4.4)	100	(2.2)	353	(9.1)	398	(6.0)	466	(4.8)	601	(5.2)	653	(5.8)	682	(4.8)
United Kingdom	529	(2.5)	92	(1.6)	374	(5.9)	412	(3.6)	470	(3.2)	592	(3.2)	646	(4.3)	676	(5.9)
United States	493	(7.6)	98	(2.4)	327	(11.7)	361	(9.6)	427	(9.7)	562	(7.5)	620	(7.7)	652	(7.9)
OECD total	***498***	***(2.1)***	***103***	***(0.9)***	***318***	***(3.1)***	***358***	***(3.4)***	***429***	***(3.0)***	***572***	***(2.1)***	***628***	***(1.9)***	***658***	***(2.1)***
OECD average	***500***	***(0.7)***	***100***	***(0.4)***	***326***	***(1.5)***	***367***	***(1.4)***	***435***	***(1.1)***	***571***	***(0.8)***	***625***	***(0.9)***	***655***	***(1.1)***
Non-OECD Countries																
Brazil	334	(3.7)	97	(2.3)	179	(5.5)	212	(5.2)	266	(4.2)	399	(5.5)	464	(7.5)	499	(8.9)
Latvia	463	(4.5)	103	(2.6)	288	(9.0)	328	(8.9)	393	(5.7)	536	(6.2)	593	(5.6)	625	(6.6)
Liechtenstein	514	(7.0)	96	(6.0)	343	(19.7)	380	(18.9)	454	(15.5)	579	(7.5)	635	(16.9)	665	(15.0)
Russian Federation	478	(5.5)	104	(2.5)	305	(9.0)	343	(7.4)	407	(6.6)	552	(6.6)	613	(6.8)	648	(7.8)

SOURCE: PISA 2000 International Report Table 3.1

Table A3.12 Multiple Comparisons of Mathematical Literacy Achievement of the Top Five Per Cent of Students per Country

Country			New Zealand	Japan	Switzerland	Australia	United Kingdom	Korea	Belgium	Canada	Liechtenstein*	Finland	Austria	Sweden	France	Czech Republic	United States	Iceland	Denmark	Germany	Russian Federation*	Hungary	Norway	Poland	Ireland	Latvia*	Spain	Greece	Italy	Portugal	Luxembourg	Mexico	Brazil*
	Mean		689	688	682	679	676	676	672	668	665	664	661	656	656	655	652	649	649	649	648	648	643	632	630	625	621	617	600	596	588	527	499
		SE	5.2	6.1	4.8	5.8	5.9	5.3	3.5	2.6	15.0	3.5	5.2	5.5	4.6	5.6	7.9	5.5	4.6	3.9	7.8	6.9	4.5	8.5	5.0	6.6	3.1	8.6	6.1	5.0	3.9	6.6	8.9
New Zealand	689	5.2		0	0	0	0	0	0	1		1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	688	6.1	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Switzerland	682	4.8	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	679	5.8	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	676	5.9	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1
Korea	676	5.3	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1
Belgium	672	3.5	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1
Canada	668	2.6	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	0	0	1	1	1	1	1	1	1	1	1	1	1
Liechtenstein*	665	15.0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Finland	664	3.5	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1
Austria	661	5.2	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Sweden	656	5.5	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
France	656	4.6	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
Czech Republic	655	5.6	-1	-1	-1	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1
United States	652	7.9	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1
Iceland	649	5.5	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	0	1	1	1	1	1
Denmark	649	4.6	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1	1	1
Germany	649	3.9	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1	1	1
Russian Federation*	648	7.8	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	0	1	1	1	1	1
Hungary	648	6.9	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	0	1	1	1	1	1
Norway	643	4.5	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0	0	0		0	0	0	1	0	1	1	1	1	1
Poland	632	8.5	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	1
Ireland	630	5.0	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	1	1	1	1	1
Latvia*	625	6.6	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	1	1	1	1
Spain	621	3.1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	1	1	1	1
Greece	617	8.6	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1	0	0	-1	-1	0	0	0	0	0	0	0		0	0	0	1	1
Italy	600	6.1	-1	-1	-1	-1	-1	-1	-1	-1	1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0		0	0	1	1
Portugal	596	5.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	1	1
Luxembourg	588	3.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		1	1
Mexico	527	6.6	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		0
Brazil*	499	8.9	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	

Note: OECD average = 655

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lower than in comparison country

Table A3.13 Multiple Comparisons of Mean Performance on the Scientific Literacy Scale

Countries	Mean	SE	Korea	Japan	Finland	United Kingdom	Canada	New Zealand	Australia	Austria	Ireland	Sweden	Czech Republic	France	Norway	United States	Hungary	Iceland	Belgium	Switzerland	Spain	Germany	Poland	Denmark	Italy	Liechtenstein	Greece	Russian Federation	Latvia	Portugal	Luxembourg	Mexico	Brazil
	Mean		552	550	538	532	529	528	528	519	513	512	511	500	500	499	496	496	496	496	491	487	483	481	478	476	461	460	460	459	443	422	375
		SE	(2.7)	(5.5)	(2.5)	(2.7)	(1.6)	(2.4)	(3.5)	(2.5)	(3.2)	(2.5)	(2.4)	(3.2)	(2.7)	(7.3)	(4.2)	(2.2)	(4.3)	(4.4)	(3.0)	(2.4)	(5.1)	(2.8)	(3.1)	(7.1)	(4.9)	(4.7)	(5.6)	(4.0)	(2.3)	(3.2)	(3.3)
Korea	552	(2.7)		0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Japan	550	(5.5)	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Finland	538	(2.5)	-1	0		0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
United Kingdom	532	(2.7)	-1	0	0		0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Canada	529	(1.6)	-1	-1	0	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
New Zealand	528	(2.4)	-1	-1	0	0	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Australia	528	(3.5)	-1	-1	0	0	0	0		0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Austria	519	(2.5)	-1	-1	-1	-1	-1	0	0		0	0	0	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Ireland	513	(3.2)	-1	-1	-1	-1	-1	-1	0	0		0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Sweden	512	(2.5)	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Czech Republic	511	(2.4)	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	1	1	1	0	1	1	1	1	1	1	1	1	1	1	1	1	1
France	500	(3.2)	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	0	1	0	1	1	0	1	1	1	1	1	1	1
Norway	500	(2.7)	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0		0	0	0	0	0	0	1	0	1	1	1	1	1	1	1	1	1	1
United States	499	(7.3)	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Hungary	496	(4.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	0	0	0	0	0	1	0	1	1	1	1	1	1	1
Iceland	496	(2.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Belgium	496	(4.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0		0	0	0	0	0	1	0	1	1	1	1	1	1	1
Switzerland	496	(4.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	1	0	1	1	1	1	1	1	1
Spain	491	(3.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	1	1	1	1	1	1	1
Germany	487	(2.4)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1	1	1	1
Poland	483	(5.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	1	1	0	1	1	1	1
Denmark	481	(2.8)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	-1	0	0	0	0	0		0	0	1	1	1	1	1	1	1
Italy	478	(3.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	0	0	0	0		0	0	0	0	1	1	1	1
Liechtenstein	476	(7.1)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0	0	0		0	0	0	0	1	1	1
Greece	461	(4.9)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0		0	0	0	1	1	1
Russian Federation	460	(4.7)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0		0	0	1	1	1
Latvia	460	(5.6)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0		0	0	1	1
Portugal	459	(4.0)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		1	1	1
Luxembourg	443	(2.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1		1	1
Mexico	422	(3.2)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1		1
Brazil	375	(3.3)	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	

SOURCE: PISA 2000 International Report Figure 3.5

Statistically significantly above the OECD average

Not statistically significantly different from the OECD average

Statistically significantly below the OECD average

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is statistically significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

1	Average performance statistically significantly higher than in comparison country
0	No statistically significant difference from comparison country
-1	Average performance statistically significantly lowerer than in comparison country

Table A3.14 Variation in Student Performance on the Scientific Literacy Scale

Country	Mean		Standard deviation		Percentiles											
					5th		10th		25th		75th		90th		95th	
	Mean score	S.E.	S.D.	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.	Score	S.E.
OECD Countries																
Australia	528	(3.5)	94	(1.6)	368	(5.1)	402	(4.7)	463	(4.6)	596	(4.8)	646	(5.1)	675	(4.8)
Austria	519	(2.6)	91	(1.7)	363	(5.7)	398	(4.0)	456	(3.8)	584	(3.5)	633	(4.1)	659	(4.3)
Belgium	496	(4.3)	111	(3.8)	292	(13.5)	346	(10.2)	424	(6.6)	577	(3.5)	630	(2.6)	656	(3.0)
Canada	529	(1.6)	89	(1.1)	380	(3.7)	412	(3.4)	469	(2.2)	592	(1.8)	641	(2.2)	670	(3.0)
Czech Republic	511	(2.4)	94	(1.5)	355	(5.6)	389	(4.0)	449	(3.6)	577	(3.8)	632	(4.1)	663	(4.9)
Denmark	481	(2.8)	103	(2.0)	310	(6.0)	347	(5.3)	410	(4.8)	554	(3.5)	613	(4.4)	645	(4.7)
Finland	538	(2.5)	86	(1.2)	391	(5.2)	425	(4.2)	481	(3.5)	598	(3.0)	645	(4.3)	674	(4.3)
France	500	(3.2)	102	(2.0)	329	(6.1)	363	(5.4)	429	(5.3)	575	(4.0)	631	(4.2)	663	(4.9)
Germany	487	(2.4)	102	(2.0)	314	(9.5)	350	(6.0)	417	(4.9)	560	(3.3)	618	(3.5)	649	(4.7)
Greece	461	(4.9)	97	(2.6)	300	(9.3)	334	(8.3)	393	(7.0)	530	(5.3)	585	(5.3)	616	(5.8)
Hungary	496	(4.2)	103	(2.3)	328	(7.5)	361	(4.9)	423	(5.5)	570	(4.8)	629	(5.1)	659	(8.5)
Iceland	496	(2.2)	88	(1.6)	351	(7.0)	381	(4.3)	436	(3.7)	558	(3.1)	607	(4.1)	635	(4.8)
Ireland	513	(3.2)	92	(1.7)	361	(6.5)	394	(5.7)	450	(4.4)	578	(3.4)	630	(4.6)	661	(5.4)
Italy	478	(3.1)	98	(2.6)	315	(7.1)	349	(6.2)	411	(4.4)	547	(3.5)	602	(4.0)	633	(4.4)
Japan	550	(5.5)	90	(3.0)	391	(11.3)	430	(9.9)	495	(7.2)	612	(5.0)	659	(4.7)	688	(5.7)
Korea	552	(2.7)	81	(1.8)	411	(5.3)	442	(5.3)	499	(4.0)	610	(3.4)	652	(3.9)	674	(5.7)
Luxembourg	443	(2.3)	96	(2.0)	278	(7.2)	320	(6.8)	382	(3.4)	510	(2.8)	563	(4.4)	593	(4.0)
Mexico	422	(3.2)	77	(2.1)	303	(4.8)	325	(4.6)	368	(3.1)	472	(4.7)	525	(5.5)	554	(7.0)
New Zealand	528	(2.4)	101	(2.3)	357	(5.6)	392	(5.2)	459	(3.8)	600	(3.4)	653	(5.0)	683	(5.1)
Norway	500	(2.8)	96	(2.0)	338	(7.3)	377	(6.6)	437	(4.0)	569	(3.5)	619	(3.9)	649	(6.2)
Poland	483	(5.1)	97	(2.7)	326	(9.2)	359	(5.8)	415	(5.5)	553	(7.3)	610	(7.6)	639	(7.5)
Portugal	459	(4.0)	89	(1.6)	317	(5.0)	343	(5.1)	397	(5.2)	521	(4.7)	575	(5.0)	604	(5.3)
Spain	491	(3.0)	95	(1.8)	333	(5.1)	367	(4.3)	425	(4.4)	558	(3.5)	613	(3.9)	643	(5.5)
Sweden	512	(2.5)	93	(1.4)	357	(5.7)	390	(4.6)	446	(4.1)	578	(3.0)	630	(3.4)	660	(4.5)
Switzerland	496	(4.4)	100	(2.4)	332	(5.8)	366	(5.4)	427	(5.1)	567	(6.4)	626	(6.4)	656	(9.0)
United Kingdom	532	(2.7)	98	(2.0)	366	(6.8)	401	(6.0)	466	(3.8)	602	(3.9)	656	(4.7)	687	(5.0)
United States	499	(7.3)	101	(2.9)	330	(11.7)	368	(10.0)	430	(9.6)	571	(8.0)	628	(7.0)	658	(8.4)
OECD total	***502***	***(2.0)***	***102***	***(0.9)***	***332***	***(3.3)***	***368***	***(3.1)***	***431***	***(2.8)***	***576***	***(2.1)***	***631***	***(1.9)***	***662***	***(2.3)***
OECD average	***500***	***(0.7)***	***100***	***(0.5)***	***332***	***(1.5)***	***368***	***(1.0)***	***431***	***(1.0)***	***572***	***(0.8)***	***627***	***(0.8)***	***657***	***(1.2)***
Non-OECD Countries																
Brazil	375	(3.3)	90	(2.3)	230	(5.5)	262	(5.9)	315	(3.7)	432	(4.9)	492	(7.8)	531	(8.2)
Latvia	460	(5.6)	98	(3.0)	299	(10.1)	334	(8.8)	393	(7.7)	528	(5.7)	585	(7.2)	620	(8.0)
Liechtenstein	476	(7.1)	94	(5.4)	314	(23.5)	357	(20.0)	409	(12.3)	543	(12.7)	595	(12.4)	629	(24.0)
Russian Federation	460	(4.7)	99	(2.0)	298	(6.5)	333	(5.4)	392	(6.2)	529	(5.8)	591	(5.9)	625	(5.7)

SOURCE: PISA 2000 International Report Table 3.3

Table A3.15 Multiple Comparisons of Scientific Literacy Achievement of the Top Five Per Cent of Students per Country

Country			Japan	United Kingdom	New Zealand	Australia	Finland	Korea	Canada	France	Czech Republic	Ireland	Sweden	Austria	Hungary	United States	Switzerland	Belgium	Germany	Norway	Denmark	Spain	Poland	Iceland	Italy	Liechtenstein*	Russian Federation*	Latvia*	Greece	Portugal	Luxembourg	Mexico	Brazil*
	Mean		688	687	683	675	674	674	670	663	663	661	660	659	659	658	656	656	649	649	645	643	639	635	633	629	625	620	616	604	593	554	531
		SE	5.7	5	5.1	4.8	4.3	5.7	3	4.9	4.9	5.4	4.5	4.3	8.5	8.4	9	3	4.7	6.2	4.7	5.5	7.5	4.8	4.4	24	5.7	8	5.8	5.3	4	7	8.2
Japan	688	5.7		0	0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
United Kingdom	687	5.0	0		0	0	0	0	0	1	1	1	1	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
New Zealand	683	5.1	0	0		0	0	0	0	0	0	0	1	1	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
Australia	675	4.8	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
Finland	674	4.3	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1	1	0	1	1	1	1	1	1	1
Korea	674	5.7	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1
Canada	670	3.0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	0	1	1	1	1	1	1	1
France	663	4.9	-1	-1	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Czech Republic	663	4.9	-1	-1	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Ireland	661	5.4	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Sweden	660	4.5	-1	-1	-1	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Austria	659	4.3	-1	-1	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Hungary	659	8.5	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
United States	658	8.4	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1	1
Switzerland	656	9.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1
Belgium	656	3.0	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0		0	0	0	0	0	1	1	0	1	1	1	1	1	1	1
Germany	649	4.7	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	0	1	1	1	1	1
Norway	649	6.2	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	0	1	1	1	1	1
Denmark	645	4.7	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	0	1	1	1	1	1
Spain	643	5.5	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1	1
Poland	639	7.5	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1	1	1	1
Iceland	635	4.8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	-1	0	0	0	0	0		0	0	0	0	0	1	1	1	1
Italy	633	4.4	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	-1	0	0	0	0	0	0		0	0	0	0	1	1	1	1
Liechtenstein*	629	24.0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0		0	0	0	0	0	0	1
Russian Federation*	625	5.7	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	0	0	0	0	0	0	0		0	0	0	1	1	1
Latvia*	620	8.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	0	0	0	0	0	0	0	0		0	0	0	1	1
Greece	616	5.8	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0	0	0		0	1	1	1
Portugal	604	5.3	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	0	0	0		0	1	1
Luxembourg	593	4.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	0	-1	0		1	1
Mexico	554	7.0	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	-1	-1	-1	-1	-1		0
Brazil*	531	8.2	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	-1	0	

Note: OECD average = 657

Instructions: Read across the row for a country to compare performance with the countries listed along the top of the chart. The symbols indicate whether the average performance of the country in the row is significantly lower than that of the comparison country, significantly higher than that of the comparison country, or if there is no statistically significant difference between the average performance of the two countries.

- 1 Average performance statistically significantly higher than in comparison country
- 0 No statistically significant difference from comparison country
- -1 Average performance statistically significantly lower than in comparison country

Table A3.16 Index of Engagement in Reading and Performance on the Total Reading Literacy Scale, by National Quarters of the Index
Results based on students' self-reports

Country	Index of engagement in reading[1]														Performance on the combined reading literacy scale, by national quarters of the index of engagement in reading[2]								Change in the combined reading literacy score per unit of the index of engagement in reading[2]	
	All students		Males		Females		Bottom quarter		Second quarter		Third quarter		Top quarter		Bottom quarter		Second quarter		Third quarter		Top quarter			
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Change	S.E.
OECD countries																								
Australia	-0.07	(0.03)	-0.29	(0.03)	0.16	(0.03)	-1.26	(0.02)	-0.39	(0.01)	0.15	(0.01)	1.21	(0.02)	**479**	(3.8)	496	(4.4)	551	(3.8)	**591**	(4.2)	**41.8**	(2.06)
Austria	-0.04	(0.03)	-0.47	(0.03)	0.35	(0.03)	-1.46	(0.02)	-0.55	(0.01)	0.27	(0.01)	1.57	(0.03)	**468**	(3.3)	483	(3.3)	519	(3.2)	**560**	(3.1)	**29.3**	(1.35)
Belgium	-0.25	(0.02)	-0.52	(0.02)	0.04	(0.02)	-1.43	(0.01)	-0.61	(0.01)	-0.01	(0.00)	1.07	(0.02)	**483**	(3.8)	489	(4.2)	513	(4.7)	**562**	(5.3)	**30.8**	(1.71)
Canada	0.00	(0.01)	-0.31	(0.01)	0.30	(0.02)	-1.31	(0.01)	-0.37	(0.00)	0.26	(0.00)	1.40	(0.01)	**486**	(1.9)	514	(2.1)	552	(2.0)	**590**	(1.6)	**36.2**	(0.70)
Czech Republic	0.17	(0.02)	-0.24	(0.03)	0.54	(0.03)	-1.03	(0.02)	-0.19	(0.01)	0.44	(0.01)	1.47	(0.02)	**459**	(3.0)	476	(2.8)	518	(3.0)	**550**	(3.0)	**33.8**	(1.48)
Denmark	0.00	(0.02)	-0.31	(0.02)	0.32	(0.03)	-1.18	(0.01)	-0.35	(0.01)	0.25	(0.01)	1.30	(0.02)	**452**	(3.7)	476	(3.4)	511	(3.4)	**555**	(3.5)	**40.0**	(1.69)
Finland	0.20	(0.02)	-0.28	(0.02)	0.64	(0.02)	-1.07	(0.02)	-0.16	(0.01)	0.46	(0.01)	1.56	(0.02)	**493**	(3.2)	526	(4.5)	566	(3.6)	**604**	(2.5)	**40.0**	(1.13)
France	-0.06	(0.02)	-0.34	(0.02)	0.19	(0.02)	-1.26	(0.01)	-0.39	(0.01)	0.17	(0.01)	1.24	(0.02)	**479**	(3.2)	489	(3.9)	518	(4.1)	**552**	(2.9)	**27.5**	(1.29)
Germany	-0.08	(0.03)	-0.50	(0.03)	0.32	(0.03)	-1.51	(0.01)	-0.58	(0.01)	0.24	(0.01)	1.50	(0.02)	**453**	(4.1)	466	(3.2)	505	(4.7)	**555**	(3.5)	**33.3**	(1.59)
Greece	-0.01	(0.02)	-0.22	(0.02)	0.19	(0.02)	-0.87	(0.02)	-0.26	(0.00)	0.15	(0.01)	0.92	(0.02)	**452**	(6.3)	454	(5.7)	478	(5.4)	**520**	(5.2)	**35.7**	(3.51)
Hungary	0.07	(0.02)	-0.15	(0.03)	0.29	(0.03)	-0.91	(0.01)	-0.25	(0.00)	0.23	(0.01)	1.20	(0.02)	**440**	(4.0)	453	(5.3)	493	(5.1)	**539**	(4.1)	**43.0**	(2.10)
Iceland	0.02	(0.02)	-0.24	(0.02)	0.27	(0.02)	-1.09	(0.02)	-0.29	(0.01)	0.22	(0.01)	1.23	(0.02)	**456**	(2.9)	488	(2.5)	526	(2.6)	**566**	(2.9)	**43.7**	(1.59)
Ireland	-0.07	(0.02)	-0.36	(0.03)	0.21	(0.03)	-1.26	(0.01)	-0.41	(0.01)	0.18	(0.01)	1.21	(0.02)	**482**	(3.9)	505	(4.0)	536	(4.1)	**588**	(3.2)	**40.1**	(1.63)
Italy	0.00	(0.03)	-0.28	(0.02)	0.29	(0.03)	-1.14	(0.02)	-0.34	(0.01)	0.23	(0.01)	1.25	(0.02)	**463**	(4.0)	468	(3.3)	491	(4.2)	**532**	(3.0)	**28.0**	(1.75)
Japan	0.09	(0.03)	-0.07	(0.03)	0.24	(0.04)	-1.16	(0.01)	-0.33	(0.01)	0.29	(0.01)	1.54	(0.02)	**499**	(5.2)	509	(5.9)	526	(5.9)	**562**	(4.4)	**23.8**	(1.55)
Korea	0.02	(0.02)	-0.08	(0.02)	0.14	(0.04)	-0.97	(0.01)	-0.31	(0.00)	0.18	(0.01)	1.16	(0.02)	**494**	(2.9)	513	(3.1)	535	(2.7)	**558**	(2.6)	**25.9**	(1.26)
Luxembourg	-0.10	(0.02)	-0.43	(0.02)	0.23	(0.02)	-1.38	(0.02)	-0.45	(0.01)	0.16	(0.01)	1.29	(0.02)	**436**	(2.8)	434	(3.0)	436	(3.7)	**494**	(3.4)	**19.4**	(1.66)
Mexico	0.29	(0.02)	0.12	(0.02)	0.46	(0.02)	-0.58	(0.02)	0.02	(0.00)	0.44	(0.01)	1.29	(0.02)	**413**	(5.3)	408	(3.8)	420	(4.1)	**445**	(4.5)	**14.6**	(2.59)
New Zealand	0.01	(0.02)	-0.21	(0.02)	0.22	(0.02)	-1.10	(0.02)	-0.30	(0.01)	0.21	(0.01)	1.23	(0.02)	**487**	(3.1)	501	(4.5)	548	(4.4)	**591**	(4.2)	**43.7**	(1.95)
Norway	-0.22	(0.02)	-0.54	(0.02)	0.12	(0.03)	-1.38	(0.02)	-0.56	(0.01)	0.02	(0.01)	1.07	(0.02)	**461**	(5.1)	484	(3.9)	514	(3.9)	**570**	(3.1)	**42.5**	(2.12)
Poland	-0.01	(0.03)	-0.23	(0.03)	0.22	(0.03)	-0.97	(0.02)	-0.31	(0.01)	0.13	(0.01)	1.13	(0.03)	**460**	(5.7)	454	(5.2)	483	(4.9)	**537**	(5.9)	**34.1**	(3.09)
Portugal	0.31	(0.02)	-0.02	(0.02)	0.63	(0.02)	-0.75	(0.02)	0.01	(0.01)	0.51	(0.01)	1.49	(0.02)	**436**	(4.6)	449	(5.9)	483	(4.7)	**521**	(4.5)	**33.5**	(1.72)
Spain	-0.04	(0.02)	-0.30	(0.02)	0.20	(0.03)	-1.17	(0.01)	-0.38	(0.00)	0.16	(0.01)	1.22	(0.02)	**460**	(3.5)	476	(3.4)	501	(3.4)	**539**	(2.9)	**31.3**	(1.42)
Sweden	-0.06	(0.02)	-0.35	(0.03)	0.24	(0.03)	-1.27	(0.01)	-0.45	(0.01)	0.19	(0.01)	1.28	(0.02)	**469**	(2.8)	496	(3.3)	527	(3.5)	**576**	(3.2)	**39.5**	(1.55)
Switzerland	0.06	(0.03)	-0.39	(0.03)	0.51	(0.03)	-1.38	(0.02)	-0.37	(0.01)	0.38	(0.01)	1.60	(0.02)	**447**	(4.2)	470	(4.7)	509	(4.9)	**556**	(5.1)	**34.8**	(1.74)
United Kingdom	-0.10	(0.02)	-0.32	(0.02)	0.12	(0.03)	-1.22	(0.02)	-0.39	(0.00)	0.12	(0.01)	1.10	(0.02)	**481**	(2.7)	503	(3.3)	536	(3.3)	**583**	(3.8)	**40.4**	(1.55)
United States	-0.13	(0.03)	-0.34	(0.04)	0.06	(0.04)	-1.30	(0.02)	-0.43	(0.01)	0.05	(0.01)	1.16	(0.03)	**474**	(6.2)	481	(9.8)	514	(8.6)	**566**	(6.2)	**33.0**	(2.22)
OECD total	***-0.01***	***(0.01)***	***-0.24***	***(0.01)***	***0.21***	***(0.01)***	***-1.17***	***(0.01)***	***-0.36***	***(0.00)***	***0.19***	***(0.00)***	***1.27***	***(0.01)***	***470***	***(1.7)***	***480***	***(2.6)***	***508***	***(2.4)***	***550***	***(2.0)***	***28.1***	***(0.84)***
OECD average	***0.00***	***(0.00)***	***-0.28***	***(0.01)***	***0.28***	***(0.01)***	***-1.16***	***(0.00)***	***-0.35***	***(0.00)***	***0.23***	***(0.00)***	***1.29***	***(0.00)***	***465***	***(0.8)***	***480***	***(0.8)***	***512***	***(0.9)***	***554***	***(0.8)***	***32.4***	***(0.39)***
Non-OECD Countries																								
Brazil	0.15	(0.02)	-0.12	(0.02)	0.38	(0.02)	-0.83	(0.01)	-0.19	(0.01)	0.31	(0.01)	1.30	(0.03)	**386**	(4.3)	379	(4.1)	396	(3.9)	**431**	(4.5)	**20.6**	(2.24)
Latvia	-0.04	(0.02)	-0.29	(0.03)	0.19	(0.03)	-0.94	(0.01)	-0.33	(0.00)	0.12	(0.01)	0.97	(0.02)	**422**	(6.8)	439	(5.5)	467	(5.8)	**511**	(6.4)	**42.3**	(3.33)
Liechtenstein	-0.08	(0.06)	-0.46	(0.07)	0.31	(0.09)	-1.37	(0.04)	-0.51	(0.02)	0.18	(0.02)	1.39	(0.08)	**441**	(8.7)	446	(10.5)	503	(10.4)	**543**	(7.4)	**35.7**	(4.01)
Russian Federation	0.05	(0.01)	-0.12	(0.02)	0.22	(0.02)	-0.82	(0.01)	-0.25	(0.00)	0.18	(0.00)	1.08	(0.01)	**431**	(4.9)	446	(4.0)	470	(4.2)	**504**	(5.8)	**34.9**	(1.71)

SOURCE: PISA 2000 International Report Table 4.3

1. For the definition of the index see Appendix 4.

Unit changes marked in bold are statistically significant. Where bottom and top quarters are marked in bold this indicates that their difference is statistically significant.

Netherlands[3]	-0.27	(0.03)	-0.55	(0.04)	0.02	(0.04)	-1.36	(0.02)	-0.60	(0.01)	-0.04	(0.01)	0.95	(0.03)	**507**	(3.7)	512	(6.0)	538	(5.2)	**572**	(4.3)	**27.6**	(2.13)

3. Response rate is too low to ensure comparability.

Table A3.17 Index on Comfort with and Perceived Ability to Use Computers and Performance on the Total Reading Literacy Scale, by National Quarters of the Index

Results based on students' self-reports

Countries	Index of comfort with and perceived ability to use computers[1]														Performance on the combined reading literacy scale, by national quarters of the index of comfort in and perceived ability to use computers[2]								Change in the combined reading literacy score per unit of the index of comfort in and perceived ability to use computers[2]	
	All students		Males		Females		Bottom quarter		Second quarter		Third quarter		Top quarter		Bottom quarter		Second quarter		Third quarter		Top quarter			
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Mean score	S.E.	Change	S.E.
OECD Countries																								
Australia	0.44	(0.02)	0.56	(0.02)	0.30	(0.03)	-0.75	(0.02)	0.08	(0.01)	0.81	(0.01)	1.61	(0.01)	**505**	(5.1)	525	(4.3)	543	(5.0)	**546**	(4.2)	**18.0**	(1.87)
Belgium	0.15	(0.02)	0.35	(0.02)	-0.07	(0.02)	-1.11	(0.02)	-0.20	(0.01)	0.49	(0.01)	1.40	(0.01)	**508**	(4.4)	518	(4.3)	515	(3.6)	**527**	(4.0)	**7.8**	(1.74)
Canada	0.49	(0.01)	0.67	(0.01)	0.32	(0.01)	-0.71	(0.01)	0.17	(0.00)	0.86	(0.00)	1.66	(0.01)	**515**	(2.4)	535	(2.1)	542	(1.8)	**549**	(2.1)	**14.7**	(0.91)
Czech Republic	-0.31	(0.02)	-0.07	(0.02)	-0.53	(0.02)	-1.39	(0.02)	-0.55	(0.01)	-0.11	(0.01)	0.82	(0.01)	**482**	(3.2)	503	(3.1)	506	(3.2)	**519**	(3.8)	**16.3**	(1.69)
Denmark	-0.05	(0.02)	0.31	(0.03)	-0.41	(0.02)	-1.20	(0.02)	-0.43	(0.01)	0.19	(0.01)	1.24	(0.01)	**486**	(4.1)	503	(3.5)	504	(3.8)	**510**	(4.0)	**10.6**	(2.21)
Finland	-0.12	(0.02)	0.19	(0.02)	-0.42	(0.02)	-1.29	(0.02)	-0.45	(0.01)	0.10	(0.01)	1.15	(0.01)	**541**	(3.8)	548	(3.7)	551	(3.3)	**553**	(3.7)	**4.5**	(1.55)
Germany	-0.31	(0.02)	-0.07	(0.02)	-0.53	(0.02)	-1.36	(0.02)	-0.59	(0.01)	-0.13	(0.00)	0.86	(0.02)	496	(4.1)	501	(3.1)	495	(3.3)	497	(4.6)	**12.3**	(1.99)
Hungary	-0.34	(0.02)	-0.20	(0.02)	-0.48	(0.02)	-1.37	(0.02)	-0.60	(0.01)	-0.12	(0.01)	0.72	(0.02)	**471**	(4.5)	471	(5.3)	489	(3.8)	**498**	(4.8)	**12.3**	(1.48)
Ireland	-0.13	(0.03)	-0.08	(0.04)	-0.19	(0.03)	-1.47	(0.02)	-0.49	(0.01)	0.15	(0.01)	1.27	(0.02)	**516**	(3.8)	519	(4.2)	531	(4.5)	**548**	(4.0)	**12.0**	(2.05)
Luxembourg	-0.09	(0.02)	0.11	(0.03)	-0.29	(0.03)	-1.28	(0.02)	-0.45	(0.01)	0.11	(0.01)	1.27	(0.02)	458	(3.7)	459	(3.5)	458	(3.3)	449	(3.6)	-3.4	(2.01)
Mexico	-0.19	(0.03)	-0.14	(0.04)	-0.23	(0.04)	-1.44	(0.02)	-0.44	(0.01)	0.12	(0.01)	1.01	(0.02)	**400**	(3.5)	419	(4.3)	427	(4.3)	**454**	(5.4)	**19.2**	(2.07)
New Zealand	0.24	(0.02)	0.27	(0.03)	0.21	(0.02)	-0.95	(0.02)	-0.13	(0.01)	0.59	(0.01)	1.45	(0.01)	**511**	(5.0)	528	(4.1)	541	(4.1)	**552**	(3.8)	**16.5**	(2.05)
Norway	-0.01	(0.02)	0.35	(0.03)	-0.37	(0.02)	-1.31	(0.02)	-0.54	(0.02)	0.36	(0.00)	1.46	(0.02)	505	(4.6)	517	(3.7)	513	(3.8)	506	(4.0)	0.5	(1.60)
Sweden	-0.09	(0.02)	0.22	(0.02)	-0.41	(0.02)	-1.14	(0.02)	-0.40	(0.01)	0.08	(0.01)	1.10	(0.02)	510	(4.0)	517	(3.3)	524	(2.7)	518	(3.4)	**4.9**	(2.00)
Switzerland	-0.26	(0.02)	-0.03	(0.02)	-0.48	(0.02)	-1.28	(0.01)	-0.55	(0.00)	-0.11	(0.00)	0.92	(0.02)	**477**	(5.5)	497	(4.8)	500	(4.9)	**510**	(4.7)	**12.9**	(1.83)
United States	0.62	(0.02)	0.70	(0.03)	0.54	(0.03)	-0.53	(0.03)	0.30	(0.01)	0.95	(0.01)	1.76	(0.01)	**480**	(7.3)	511	(7.6)	529	(6.3)	**532**	(7.9)	**24.2**	(2.37)
OECD total	***0.25***	***(0.02)***	***0.37***	***(0.02)***	***0.14***	***(0.02)***	***-0.91***	***(0.02)***	***-0.06***	***(0.01)***	***0.55***	***(0.01)***	***1.41***	***(0.01)***	***475***	***(3.5)***	***497***	***(3.7)***	***508***	***(3.3)***	***515***	***(3.8)***	***22.4***	***(1.40)***
OECD average	***0.00***	***(0.00)***	***0.2***	***(0.01)***	***-0.19***	***(0.01)***	***-1.16***	***(0.00)***	***-0.33***	***(0.00)***	***0.27***	***(0.00)***	***1.23***	***(0.01)***	***492***	***(1.3)***	***505***	***(1.1)***	***511***	***(1.0)***	***518***	***(1.1)***	***13.4***	***(0.50)***
Non-OECD Countries																								
Brazil	-0.50	(0.03)	-0.35	(0.04)	-0.62	(0.04)	-2.06	(0.02)	-0.80	(0.01)	-0.08	(0.01)	0.96	(0.02)	**382**	(3.9)	389	(4.1)	402	(5.6)	**432**	(4.9)	**15.3**	(1.97)
Latvia	-0.22	(0.02)	-0.07	(0.03)	-0.35	(0.03)	-1.26	(0.02)	-0.48	(0.01)	-0.03	(0.01)	0.90	(0.02)	456	(6.8)	463	(6.7)	460	(6.8)	468	(6.2)	**7.2**	(2.50)
Liechtenstein	-0.27	(0.05)	-0.02	(0.08)	-0.52	(0.05)	-1.16	(0.05)	-0.52	(0.02)	-0.13	(0.01)	0.79	(0.07)	469	(11.2)	486	(10.5)	490	(10.0)	490	(9.4)	11.4	(6.35)
Russian Federation	-0.31	(0.02)	-0.24	(0.03)	-0.39	(0.02)	-1.45	(0.02)	-0.56	(0.00)	-0.10	(0.01)	0.84	(0.02)	**449**	(5.6)	466	(4.1)	469	(4.2)	**478**	(4.5)	-0.5	(2.35)

SOURCE: PISA 2000 International Report Table 4.11

1. For a definition of the index see Appendix 4.

Unit changes marked in bold are statistically significant. Where bottom and top quarters are marked in bold this indicates that their difference is statistically significant.

Table A3.18 Percentage of Students at Each Level of Proficiency on the Total Reading Literacy Scale

Country	Proficiency levels											
	Below Level 1 *(less than 335 score points)*		**Level 1** *(from 335 to 407 score points)*		**Level 2** *(from 408 to 480 score points)*		**Level 3** *(from 481 to 552 score points)*		**Level 4** *(from 553 to 625 score points)*		**Level 5** *(above 625 score points)*	
Combined reading literacy scale	**Percentage**	**S.E.**	**Percentage**	**S.E.**	**Percentage**	**S.E.**	**Percentage**	**S.E.**	**Percentage**	**S.E.**	**Percentage**	**S.E.**
OECD Countries												
Australia	3.3	(0.5)	9.1	(0.8)	19.0	(1.1)	25.7	(1.1)	25.3	(0.9)	17.6	(1.2)
Austria	4.4	(0.4)	10.2	(0.6)	21.7	(0.9)	29.9	(1.2)	24.9	(1.0)	8.8	(0.8)
Belgium	7.7	(1.0)	11.3	(0.7)	16.8	(0.7)	25.8	(0.9)	26.3	(0.9)	12.0	(0.7)
Canada	2.4	(0.3)	7.2	(0.3)	18.0	(0.4)	28.0	(0.5)	27.7	(0.6)	16.8	(0.5)
Czech Republic	6.1	(0.6)	11.4	(0.7)	24.8	(1.2)	30.9	(1.1)	19.8	(0.8)	7.0	(0.6)
Denmark	5.9	(0.6)	12.0	(0.7)	22.5	(0.9)	29.5	(1.0)	22.0	(0.9)	8.1	(0.5)
Finland	1.7	(0.5)	5.2	(0.4)	14.3	(0.7)	28.7	(0.8)	31.6	(0.9)	18.5	(0.9)
France	4.2	(0.6)	11.0	(0.8)	22.0	(0.8)	30.6	(1.0)	23.7	(0.9)	8.5	(0.6)
Germany	9.9	(0.7)	12.7	(0.6)	22.3	(0.8)	26.8	(1.0)	19.4	(1.0)	8.8	(0.5)
Greece	8.7	(1.2)	15.7	(1.4)	25.9	(1.4)	28.1	(1.7)	16.7	(1.4)	5.0	(0.7)
Hungary	6.9	(0.7)	15.8	(1.2)	25.0	(1.1)	28.8	(1.3)	18.5	(1.1)	5.1	(0.8)
Iceland	4.0	(0.3)	10.5	(0.6)	22.0	(0.8)	30.8	(0.9)	23.6	(1.1)	9.1	(0.7)
Ireland	3.1	(0.5)	7.9	(0.8)	17.9	(0.9)	29.7	(1.1)	27.1	(1.1)	14.2	(0.8)
Italy	5.4	(0.9)	13.5	(0.9)	25.6	(1.0)	30.6	(1.0)	19.5	(1.1)	5.3	(0.5)
Japan	2.7	(0.6)	7.3	(1.1)	18.0	(1.3)	33.3	(1.3)	28.8	(1.7)	9.9	(1.1)
Korea	0.9	(0.2)	4.8	(0.6)	18.6	(0.9)	38.8	(1.1)	31.1	(1.2)	5.7	(0.6)
Luxembourg	14.2	(0.7)	20.9	(0.8)	27.5	(1.3)	24.6	(1.1)	11.2	(0.5)	1.7	(0.3)
Mexico	16.1	(1.2)	28.1	(1.4)	30.3	(1.1)	18.8	(1.2)	6.0	(0.7)	0.9	(0.2)
New Zealand	4.8	(0.5)	8.9	(0.5)	17.2	(0.9)	24.6	(1.1)	25.8	(1.1)	18.7	(1.0)
Norway	6.3	(0.6)	11.2	(0.8)	19.5	(0.8)	28.1	(0.8)	23.7	(0.9)	11.2	(0.7)
Poland	8.7	(1.0)	14.6	(1.0)	24.1	(1.4)	28.2	(1.3)	18.6	(1.3)	5.9	(1.0)
Portugal	9.6	(1.0)	16.7	(1.2)	25.3	(1.0)	27.5	(1.2)	16.8	(1.1)	4.2	(0.5)
Spain	4.1	(0.5)	12.2	(0.9)	25.7	(0.7)	32.8	(1.0)	21.1	(0.9)	4.2	(0.5)
Sweden	3.3	(0.4)	9.3	(0.6)	20.3	(0.7)	30.4	(1.0)	25.6	(1.0)	11.2	(0.7)
Switzerland	7.0	(0.7)	13.3	(0.9)	21.4	(1.0)	28.0	(1.0)	21.0	(1.0)	9.2	(1.0)
United Kingdom	3.6	(0.4)	9.2	(0.5)	19.6	(0.7)	27.5	(0.9)	24.4	(0.9)	15.6	(1.0)
United States	6.4	(1.2)	11.5	(1.2)	21.0	(1.2)	27.4	(1.3)	21.5	(1.4)	12.2	(1.4)
OECD total	***6.2***	***(0.4)***	***12.1***	***(0.4)***	***21.8***	***(0.4)***	***28.6***	***(0.4)***	***21.8***	***(0.4)***	***9.4***	***(0.4)***
OECD average	***6.0***	***(0.1)***	***11.9***	***(0.2)***	***21.7***	***(0.2)***	***28.7***	***(0.2)***	***22.3***	***(0.2)***	***9.5***	***(0.1)***
Non-OECD Countries												
Brazil	23.3	(1.4)	32.5	(1.2)	27.7	(1.3)	12.9	(1.1)	3.1	(0.5)	0.6	(0.2)
Latvia	12.7	(1.3)	17.9	(1.3)	26.3	(1.1)	25.2	(1.3)	13.8	(1.1)	4.1	(0.6)
Liechtenstein	7.6	(1.5)	14.5	(2.1)	23.2	(2.9)	30.1	(3.4)	19.5	(2.2)	5.1	(1.6)
Russian Federation	9.0	(1.0)	18.5	(1.1)	29.2	(0.8)	26.9	(1.1)	13.3	(1.0)	3.2	(0.5)

SOURCE: PISA 2000 International Report Table 2.1a

Appendix **FOUR**

DEFINITION OF VARIABLES

This appendix indicates the variables that were used in analyses of the Australian PISA Student and School Questionnaire data, and shows the components of each one. More variables were measured, but some were not considered further after consultation of the PISA international report (OECD, 2001) showed that they were not significantly related to achievement in Australia. Other basic demographic variables were measured in a very straightforward way, and are therefore not included in the table below. Readers are referred to the international report for a complete listing of the variables, should this be of interest.

Each variable was measured in one of the following ways:

- from responses to a list of items to indicate presence or absence or number of the items present;
- on a 2-point scale with response categories: yes; no;
- on a 3-point scale of frequency, for example, with response categories: no, never; yes, sometimes; yes, regularly;
- on a 3-point scale of probability, for example, with response categories: not likely; likely; very likely;
- on a 4-point scale of frequency, for example, with response categories: never; some lessons; most lessons; every lesson;
- on a 4-point scale of extent of agreement, for example, with response categories: strongly disagree; disagree; agree; strongly agree;
- on a 4-point scale of extent of comfort, for example, with response categories: very comfortable; comfortable; somewhat comfortable; not at all comfortable; or
- on a 5-point scale of frequency, for example, with response categories: never or hardly ever; a few times a year; about once a month; several times a year; several times a week.

  Response categories were used in a consistent way within a set of items.

Response categories for some variables were reversed for analysis when questions were asked in a negative way, so that relationships found with achievement would be in a positive direction.

Variable	Categories	How defined
STUDENT CHARACTERISTICS AND FAMILY BACKGROUND		
Family structure	i) single parent family ii) nuclear family iii) mixed family iv) other	Student lives with: - one of mother, father, female or male guardian - mother and father - mother and male guardian; father and female guardian; or two guardians - other combinations (including other relatives)
Number of siblings		Sum of number older than, same age as, and younger than the respondent
Country of birth for each of student, mother and father	i) Australia ii) another country	(Note that in Australia a list of 11 countries, plus 'other', was provided)
Language spoken at home most of the time	i) English ii) Other national language another language	(Note that in Australia a list of 11 languages, including English and an Indigenous Australian language, plus 'other' was provided)
International Socio-Economic Index of Occupational Status (socioeconomic status)	Coded in accordance with the International Standard Classification of Occupations (ISCO); values range from 0 to 90 (low values indicate low socioeconomic status and high values indicate high socioeconomic status)	Based on students' responses about their fathers' and mothers' occupations; the higher of father's and mother's occupation is used most of the time in analyses
Books in the home	None; 1-10 books; 11-50 books; 51-100 books; 101-250 books; 251-500 books; more than 50 books	
Parents' educational attainment (school)	No schooling; primary school only; some secondary school, but not more than Year 10; Year 10 or 11 plus some training courses; Year 12	Highest level of education coded in accordance with the International Standard Classification of Education (ISCED)
Parents' educational attainment (university)	Completion of a university degree	

Variable	Categories	How defined
Social communication (parental interest)	Variables combined in an index with mean of 0 and standard deviation of 1	Frequency parents engaged with students in the following activities: i) discussing how well they are doing at school ii) eating dinner with them around a table iii)spending time simply talking with them
Participation in additional courses	*i)* students who attended additional courses in English, courses in other subjects or extensions or other additional courses ii) students who attended remedial courses in English, remedial courses in other subjects or other training to improve study skills or private tutoring	Students' attendance sometimes or regularly at any special courses outside school during the previous three years in order to improve results.
Family wealth	Variables combined in an index with mean of 0 and standard deviation of 1	Availability of various items in the home: i) dishwasher ii) a room of their own iii) educational software iv) link to the Internet v) number of mobile phones vi) number of televisions vii) number of computers viii) number of motor cars ix) number of bathrooms
Home educational resources	Variables combined in an index with mean of 0 and standard deviation of 1	Availability of various items in the home: i) dictionary ii) quiet place to study iii) school textbooks iv) number of calculators
Possessions related to classical culture	Variables combined in an index with mean of 0 and standard deviation of 1	Availability of various items in the home i) classical literature e.g. Shakespeare, Dickens, Patrick White ii) books of poetry iii) works of art, e.g. paintings

Variable	Categories	How defined
LEARNING STRATEGIES AND ATTITUDES		
Engagement in reading	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' agreement with the following statements: i) I read only if I have to ii) reading is one of my favourite hobbies iii) I like talking about books with other people iv) I find it hard to finish books v) I feel happy if I receive a book as a present vi) for me, reading is a waste of time vii) I enjoy going to a bookstore or a library viii) I read only to get information that I need ix) I cannot sit still and read for more than a few minutes
Reading for enjoyment	none; half an hour or less; more than half an hour but not as much as an hour; 1 to 2 hours; more than 2 hours	Time spent per day
Borrow books	Never/hardly ever; a few times a year; about once a month; several times a month	
Student interest in reading	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' agreement with the following statements: i) because reading is fun, I wouldn't want to give it up ii) I read in my spare time iii) when I read, I sometimes get
Student interest in mathematics	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' agreement with the following statements: i) when I do mathematics, I sometimes get totally absorbed ii) mathematics is important to me personally iii) because doing mathematics is fun, I wouldn't want to give it up
Control strategies in learning	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' agreement with the following statements: i) I start by figuring out what exactly I need to learn ii) I force myself to check to see if I remember what I have learned iii) I try to figure out which concepts I still haven't really understood iv) I make sure that I remember the most important things

Variable	Categories	How defined
		v) when I study and I don't understand something, I look for additional information to clarify this
Memorising strategies in learning	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) I try to memorise everything that might be covered ii) I memorise as much as possible iii) I memorise all new material so that I can recite it iv) I practise by saying the material to myself over and over
Elaboration strategies in learning	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on extent of students' agreement with the following statements about studying: i) I try to relate new material to things I have learned in other subjects ii) I figure out how the information might be useful in the real world iii) I try to understand the material better by relating it to things I already know iv) I figure out how the material fits in with what I have already learned
Cooperative learning	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) I like to work with other students ii) I learn the most when I work with other students iii) I do my best work when I work with other students iv) I like to help other people do well in a group v) it is helpful to put together everyone's idea when working on a project
Competitive learning	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) I like to try to be better than other students ii) trying to be better than others makes me work well iii) I would like to be the best at something

Variable	Categories	How defined
		iv) I learn things faster if I'm trying to do better than the others
Student self-concept in reading	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) I'm hopeless in English lessons ii) I learn things quickly in English lessons iii) I get good marks in English
Student self-concept in mathematics	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) I get good marks in mathematics ii) mathematics is one of my best subjects iii) I have always done well in mathematics
Interest in computers	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' responses to the following statements: i) it is very important to me to work with a computer ii) to play or work with a computer is really fun iii) I use a computer because I am very interested in this iv) I forget the time, when I am working with the computer
Comfort and perceived ability with computers	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on students' responses to the following questions: i) How comfortable are you with using a computer? ii) How comfortable are you with using a computer to write a paper? iii) How comfortable are you with taking a test on a computer? iv) If you compare yourself with other 15-year-olds, how would you rate your ability to use a computer?
Sense of belonging	Variables combined in an index with mean of 0 and standard deviation of 1	Based on students' responses to the following: My school is a place where: i) I feel left out of things ii) I make friends easily iii) I feel like I belong iv) I feel awkward and out of place v) Other students seem to like me

Variable	Categories	How defined
		vi) I feel lonely vii) I do not want to go viii) I often feel bored
Time spent on homework	Categories were 'no time'; 'less than 1 hour a week'; 'between 1 and 3 hours a week'; and '3 hours or more a week'. The variables were combined in an index with mean of 0 and standard deviation of 1	Amount of time spent per week doing homework for English, mathematics and science classes
CLASSROOM PRACTICES		
Teacher support	Variables combined in an index with mean of 0 and standard deviation of 1	Based on the frequency with which: i) the teacher shows an interest in every student's learning ii) the teacher gives students an opportunity to express opinions iii) the teacher helps students with their work iv) the teacher continues teaching until the students understand v) the teacher does a lot to help students vi) the teacher helps students with their learning
Disciplinary climate	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on the frequency with which students reported: i) the teacher has to wait a long time for students to settle down ii) students cannot work well iii) students don't listen to what the teacher says iv) students don't start working for a long time after the lesson begins v) there is noise and disorder vi) at the start of class, more than five minutes are spent doing nothing
Student-related factors affecting school climate	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on principal's perceptions of the school's disciplinary climate by reporting the extent to which the learning of 15-year-olds in their school is hindered by: i) student absenteeism ii) disruption of classes by students iii) students skipping classes iv) students lacking respect for teachers v) the use of alcohol or illegal drugs vi) students intimidating or bullying other students

Variable	Categories	How defined
Achievement press (pressure to achieve)	Variables combined in an index with mean of 0 and standard deviation of 1	Based on the frequency with which: i) the teacher wants students to work hard ii) the teacher tells students that they can do better iii) the teacher does not like it when students hand in careless work iv) students have to learn a lot
Teacher-student relations	Variables combined in an index with mean of 0 and standard deviation of 1	Based on extent of students' agreement with the following statements: i) students get along well with most teachers ii) most teachers are interested in students' well being iii) most of my teachers really listen to what I have to say iv) if I need extra help, I will receive it from my teachers v) most of my teachers treat me fairly
SCHOOL POLICIES AND PRACTICES		
Use of formal student assessments		Based on the responses from principals on the frequency of use of the following forms of assessment i) standardised tests ii) teacher-developed tests iii) teachers' judgmental ratings iv) portfolios (folder) of student work v) student assignments/projects/ homework
Use of informal assessments		Based on the responses from principals on the frequency of: i) the use of teacher-developed tests ii) teachers' judgmental ratings iii) portfolios (folders) of student work iv) student assignments/projects/homework
School autonomy	Variables combined in an index with mean of 0 and standard deviation of 1 (based on the categories that principals classified as being a school responsibility)	Principals reported on who has the main responsibility in their school for: i) hiring teachers ii) dismissing teachers iii) establishing teachers' starting salaries

Variable	Categories	How defined
		iv) determining teachers' salary increases v) formulating the school budgets vi) deciding on budget allocations within the school vii) establishing student disciplinary policies viii) establishing student assessment policies ix) approving students for admission to school x) choosing which textbooks to used xi) determining course content xii) deciding which courses are offered
Teacher autonomy	Variables combined in an index with mean of 0 and standard deviation of 1 (based on the categories that principals classified as being primarily a teacher responsibility)	See list for 'school autonomy'
Staff professional development		Based on principals' reports of the percentage of teachers involved in professional development programmes of at least one day's duration
Principals' perception of teacher-related factors affecting school climate	Variables combined in an index with mean of 0 and standard deviation of 1	Based on principals' reports on the extent to which the learning of 15-year-olds in their school is hindered by: i) low expectations of teachers ii) poor student-teacher relations iii) teachers not meeting individual students' needs iv) teacher absenteeism; staff resisting change v) teachers being too strict with students vi) students not being encouraged to achieve their full potential
Principals' perception of teacher morale and commitment	Variables combined in an index with mean of 0 and standard deviation of 1	Based on the extent to which principals agreed with the following statements: i) the morale of the teachers in this school is high ii) teachers work with enthusiasm iii) teachers take pride in this school iv) teachers value academic achievement

Variable	Categories	How defined
Shortage of teachers	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on the principals' reports on how much learning of 15-year-old students in their school is hindered by the shortage or inadequacy of: i) teachers ii) English teachers iii) mathematics teachers iv) science teachers
SCHOOL RESOURCES		
Quality of a school's physical infrastructure	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on principals' reports on the extent to which the learning of 15-year-olds in their school is hindered by: i) poor condition of buildings ii) poor heating, cooling and/or lighting systems iii) lack of instructional space (e.g., classrooms)
Quality of a school's educational resources	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on the school principals' reports on the extent to which the learning of 15-year-olds is hindered by: i) not enough computers for instruction ii) lack of instructional materials in the library iii) lack of multi-media resources for instruction iv) inadequate science laboratory equipment v) inadequate facilities for the fine arts
Availability of computers	Derived by dividing the total number of computers available to 15-year-old students by the total number of computers in the school.	Principals provided information on the total number of computers available in their schools and, more specifically, the number of computers: i) available to 15-year-olds ii) available only to teachers iii) available only to administrative staff iv) connected to the Internet v) connected to a local area network
Student-teaching staff ratio	Derived as a ratio between the numbers of full-time equivalent teachers divided by the number of students in the school.	Principals reported the numbers of full-time and part-time teachers employed in their school. A full-time teacher was defined as spending at least 90 per cent of the time as a classroom teacher and

Variable	Categories	How defined
		received a weight of 1. A part-time teacher, spending less than 90 per cent of the time as a classroom teacher, received a weight of 0.5.
Teacher qualifications	*Proportions of teachers in the respective categories (these variables were used in the analyses for Chapter 8)*	Principals indicated the numbers of teachers who: i) are English teachers ii) are mathematics teachers iii) are science teachers iv) have a Bachelors degree in education v) have a Bachelors degree, majoring in English vi) have a Bachelors degree, majoring in mathematics vii) have a Bachelors degree, majoring in science
Use of resources	*Variables combined in an index with mean of 0 and standard deviation of 1*	Based on frequency students use the following resources in their school: i) the school library ii) calculators iii) the Internet iv) science laboratories
Hours of schooling (per year)	Index derived from the product of these three factors, divided by 60	Based on the information principals provided on: i) the number of weeks in the school year the school operates ii) the number of class periods in the school week iii) the number of instructional minutes in a single class period

GLOSSARY

This glossary has two sections. The actual Glossary is preceded by a section to clarify acronyms and abbreviations.

Acronyms and abbreviations

ABS:	Australian Bureau of Statistics
ACER:	Australian Council for Educational Research
BPC:	Board of Participating Countries
DETYA:	Commonwealth Department of Education, Training and Youth Affairs
ETS:	Educational Testing Service (USA)
FEGs:	Functional Expert Groups
HISEI:	Higher of mother's and father's occupational status
HLM:	Hierarchical Linear Modeling
IALS:	International Adult Literacy Survey
IEA:	International Association for the Evaluation of Educational Achievement
IPC:	International Project Centre
ISCED:	International Standard Classification of Education
ISCO:	International Standard Classification of Occupations
IRT:	Item Response Theory
LSAY:	Longitudinal Surveys of Australian Youth
NAC:	National Advisory Committee
NCQMs:	National Centre Quality Monitors
NIER:	National Institute for Educational Research (Japan)
NPMs:	National Project Managers
OECD:	Organisation for Economic Co-operation and Development
PQMs:	PISA Quality Monitors
TAG:	PISA Technical Advisory Group
PISA:	Programme for International Student Assessment
SES:	socioeconomic status
SD:	standard deviation
SE:	standard error
CITO:	The Netherlands National Institute for Educational Measurement
TIMSS:	The Third International Mathematics and Science Study

ARIA Plus: A classification system developed by the Australian Bureau of Statistics to identify relative remoteness in terms of both distance and access to services and facilities. (Chapter 5)

assessment item: A question testing an aspect of students' knowledge and skills. Five item types were used in PISA, as follows (Chapters 3 and 4):

- ***Multiple-choice items***: these items required students to circle a letter to indicate one choice among four or five alternatives, each of which might be a number, a word, a phrase or a sentence. They were scored dichotomously and accounted for the largest proportion of items.
- ***Complex multiple-choice items***: in these items, the student made a series of choices, usually binary. Students indicated their answer by circling a word or short phrase (for example *yes* or *no*) for each point. These items were scored dichotomously for each choice, yielding the possibility of full or partial credit for the whole item.
- ***Closed constructed-response items***: these items required students to construct their own responses, there being a limited range of acceptable answers. Most of these items were scored dichotomously with a few items included in the marking process.
- ***Short response items***: as in the closed constructed-response items, students were to provide a brief answer, but there was a wide range of possible answers. These items were hand-marked, thus allowing for dichotomous as well as partial credit.
- ***Open constructed-response items***: in these items, students constructed a longer response, allowing for the possibility of a broad range of divergent, individual responses and differing viewpoints. These items usually asked students to relate information or ideas in the stimulus text to their own experience or opinions, with the acceptability depending less on the position taken by the student than on the ability to use what they had read when justifying or explaining that position. Partial credit was often permitted for partially correct or less sophisticated answers, and all of these items were marked by hand.

bivariate analysis: The analysis of two variables to study the relationship between the variables. In PISA 2000, one of the variables was usually an achievement measure. (Chapter 10)

Board of Participating Countries (BPC): A group that is responsible for setting policy objectives of PISA and the policy priorities for the implementation of the survey. (Chapter 1)

competency classes: A comprehensive set of mathematical processes which are organised into three main groups. (Chapter 4)

confidence interval: An interval containing the true value of a random variable, with a stated probability (confidence level). (Chapter 8)

confidence level: One minus the probability of rejecting the research (null) hypothesis, if this hypothesis is true. (Chapter 5)

correlation (linear): A statistical index (coefficient) representing the degree of linear co-variation of two variables. A common linear correlation is the Pearson product-moment correlation, whose values fall in the interval from +1 to –1. If the Pearson product-moment correlation is equal to +1, the relationship between the two variables may be represented by a straight line scatterplot with positive slope, and if the correlation is –1, by a straight line scatterplot with negative slope. (Chapter 2)

Cross-Curricular Competencies: PISA 2000 measured competencies across disciplinary boundaries, including student motivation, other aspects of students' attitudes towards learning, familiarity with Information Technology and self-regulated learning. (Chapter 2)

Functional Expert Groups (FEGs): These groups consisted of subject matter and technical experts from participating countries. Each assessment domain had its own FEG. (Appendix 1)

Hierarchical Linear Modeling (HLM): A statistical procedure which provides exploration of the variables that may be associated with student outcomes. Results estimate the contribution that each of the factors makes in explaining the variance within and between schools. (Chapter 8)

Higher of mother's and father's socio-economic index (HISEI): A measure of socioeconomic status using the highest status occupation of either the mother or father. (Chapter 7)

International Adult Literacy Survey (IALS): An international study of adult literacy skills, developed by the OECD and Statistics Canada, that took place between 1994 and 1998. (Chapter 1)

International Association for the Evaluation of Educational Achievement (IEA): A non-governmental association of educational research centres, set up to study organisational and curriculum-related issues in schools. (Chapter 1)

International Standard Classification of Education (ISCED): A classification system for education level. This document was used for the coding of parents' educational backgrounds. (Chapter 8)

International Standard Classification of Occupations (ISCO): A classification system for occupations. This document was used for the coding of occupations. (Chapter 7)

Item Theory Response (IRT): Typically a class of models which hypothesise the probability of a student obtaining a correct response to an administered item, where the probability depends on parameters characterising the student and the item. (Chapter 2)

Jones Classification: A classification system of relative remoteness developed in 2001 by Roger Jones for the National Education Performance Monitoring Taskforce in Australia.

literacy: (as defined by PISA) encompasses the broad range of competencies relevant to coping with adult life in today's rapidly changing societies (Chapter 1)

Longitudinal Surveys of Australian Youth (LSAY): A study examining the progress of young Australians as they leave school and commence tertiary education and/or enter the work force. (Chapter 1)

mathematical literacy: The capacity to identify, understand and engage in mathematics, and to make well-founded judgements about the role that mathematics plays in an individual's current and future private life, occupational life, social life with peers and relatives, and life as a constructive, concerned and reflective citizen. (Chapter1)

multilevel analysis: A statistical procedure which provides exploration of the variables that may be associated with student outcomes. Results provide the contribution that each of the factors make in explaining the variance within and between schools. (Chapter 8)

multiple comparisons: A statistical technique involving comparing results of several groups simultaneously. (Chapter 5)

multivariate analyses: The analysis of many variables jointly together with another variable, usually an outcome measure. In PISA 2000, this is an achievement measure. (Chapter 10)

National Centre Quality Monitors: Associates nominated by the PISA International Consortium to ensure that procedures were being followed correctly in national centres and to offer assistance if necessary. (Appendix 1)

National Project Managers: Project directors responsible for the implementation of PISA 2000 at the national level. (Appendix 1)

OECD average: Mean based on a combined random sample of 500 students from each OECD country participating in PISA. (Chapter 2)

Organisation for Economic Co-operation and Development: An international organisation that promotes policies designed to improve economic growth and employment. (Chapter 1)

per cent correct: The overall percentage of students who correctly answered an item.

percentile rank: Another name for a cumulative percentage of a distribution of test scores. See percentile score.

percentile score: The x^{th} percentile score of a group of students is a score on the relevant measurement scale. Where x% of the students have scores equal to or less than this score, x% is the percentile rank. For example, the top 10 per cent of a group are above the 90th percentile rank, and consequently have percentile scores greater than the 90th percentile score. (Chapter 2)

PISA Quality Monitors: Associates nominated by National Project Managers to observe testing sessions to ensure that the testing procedures were being implemented according to the specifications in the Test Administrator's Manual. (Appendix 1)

PISA Technical Advisory Group: A group consisting of technical experts, who oversaw the technical aspects of design for PISA 2000. (Appendix 1)

proficiency level: Students' reading results are described in terms of skills at five levels of proficiency. Each proficiency level is associated with tasks of increasing difficulty. (Chapter 3)

Programme for International Student Assessment (PISA): An international assessment producing indicators of skills in areas considered essential for full participation in twenty-first century society, on a regular basis. The study is sponsored by the OECD. (Chapter 1)

reading literacy: The ability to understand, use and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate effectively in society. (Chapter 1)

scientific literacy: The capacity to use scientific knowledge, to identify questions and to draw evidence-based conclusions in order to understand and help make decisions about the natural world and the changes made to it through human activity. (Chapter 1)

self-regulated learning: Strategies for managing and monitoring one's own learning. (Chapter 1)

social gradient: A line representing a relationship between two variables, which is not necessarily linear. The gradients are regression lines, which can be thought of as averages of the results from all the students in each of the samples. (Chapter 7)

social outcome: Any measurable trait. For the purposes of PISA, social outcome refers to the students' achievement in reading literacy, mathematical literacy or scientific literacy. (Chapter 7)

socioeconomic gradient: The relationship between a social outcome and socioeconomic status for the individuals of a specific community. (Chapter 7)

standard deviation: A measure of the spread of the scores in a distribution about the mean. (Chapter 2)

standard error: A measure of the chance fluctuations in the measurements of a variable. This gives an indication of how much the mean of a variable might fluctuate by chance with repeated measurements. (Chapter 2)

statistical significance:

table leaders: Reading, mathematics or science markers who were very experienced and managed other markers by fielding queries and addressing other issues. (Appendix 1)

The Third International Mathematics and Science Study (TIMSS): An international comparative study of mathematics and science achievement conducted under the auspices of the IEA. The study took place in 1994-95 with a repeat of the study occurring in 1998-99. (Chapter 1)

variance: A measure of variability which is the average value of the squares of the deviations from the mean of the scores in a distribution. (Chapter 8)

A note on testing the significance of differences

The statistics in this report represent *estimates* of national performance based on samples of students rather than the values that could be calculated if every student in every country had answered every question. Consequently, it is important to know the degree of uncertainty inherent in the estimates. In PISA 2000, each estimate has an associated degree of uncertainty, which is expressed through a standard error. The use of confidence intervals provides a means of making inferences about the population means and proportions in a manner that reflects the uncertainty associated with sample estimates. It can be inferred that the observed statistical result for a given population would lie within the confidence interval in 95 out of 100 replications of the measurement, using different samples drawn from the same population.

Testing whether populations differ

This report tests the statistical significance of differences between the national samples in percentages and in average performance scores in order to judge whether there are differences between the populations whom the samples represent. Each separate test follows the convention that, if in fact there is no real difference between two populations, there is no more than a 5 per cent probability that an observed difference between the two samples will erroneously suggest that the populations are different as the result of sampling and measurement error. In the figures and tables showing multiple comparisons of countries' mean scores, the significance tests are based on a procedure for multiple comparisons that limits to 5 per cent the probability that the mean of a given country will erroneously be declared to be different from that of any other country, in cases where there is in fact no difference.

15-Up and Counting, Reading, Writing, Reasoning ....

How Literate are **Australia's Students?**

How well prepared are students to meet the challenges of the future? Are they able to analyse, reason and communicate their ideas effectively? Do they have the capacity to continue learning throughout life? These are questions that parents, students, employers and those who run education systems frequently ask.

This book, *15-Up and Counting, Reading, Writing, Reasoning.... How Literate are Australia's Students?*, provides some important answers to these questions. It is the first Australian report of results from the major new OECD activity known as the Programme for International Student Assessment (PISA). The first of a planned three-yearly cycle of assessments took place in 32 countries in 2000, in randomly selected samples of schools and students.

Features of PISA

- *The literacy approach*: PISA aims to define each domain (reading, mathematics and science) not merely in terms of mastery of the school curriculum, but in terms of important knowledge and skills needed for full participation in society.
- *A long-term commitment*: spanning over the decade to come, PISA will enable countries to monitor their progress in meeting key learning objectives.
- *The age group covered*: assessing young people near the end of their compulsory schooling provides a significant indication of the performance of education systems.
- *The relevance to lifelong learning*: PISA does not limit itself to assessing the knowledge and skills of students but also asks students to report on their own, self-regulated learning, their motivation to learn and their preferences for different types of learning situations.

The report presents evidence, from the first assessment, on the performance in reading, mathematical and scientific literacy of 15-year-old students, their schools and their countries, interpreted from an Australian perspective. It gives insights into factors that influence the development of these skills at home and at school, and discusses implications of the results for policy development.

Australian students on the whole performed consistently very well in all three of the assessment domains. Only one country achieved a better result than Australia in each of reading (Finland) and mathematics (Japan), and only two countries achieved a better result in science (Korea and Japan). Within Australia, comparisons between the state and territory results show many more similarities than differences. All the state and territory results were at or above the OECD average.

While the performance of Australian students as a whole was at a high standard, the data revealed some differences of concern to educators and the community. For example, while there were no differences between boys' and girls' performances in mathematics and science, girls performed substantially better than boys in reading. The report discusses boys' and girls' strengths and weaknesses in all three domains and identifies aspects of particular concern.

PISA 2000 was implemented for the OECD by an international consortium led by the Australian Council for Educational Research (ACER). ACER also carried out the survey within Australia.

For more information about PISA, visit the OECD's website: www.pisa.oecd.org.

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