OECD PISA

Contextual factors that influence the achievement of Australia's Indigenous students: Results from PISA 2000 – 2006

Lisa De Bortoli
Sue Thomson

ACER

Programme for International Student Assessment

OECD PISA

Contextual factors that influence the achievement of Australia's Indigenous students: Results from PISA 2000 – 2006

Lisa De Bortoli
Sue Thomson

ACER

Programme for International Student Assessment

First published 2010
by ACER Press, an imprint of
Australian Council for Educational Research Ltd
19 Prospect Hill Road, Camberwell
Victoria, 3124, Australia

www.acerpress.com.au

sales@acer.edu.au

Cover and text design by ACER Project Publishing

Printed in Australia by BPA Print Group Pty Ltd

National Library of Australia Cataloguing-in-Publication data:

Author:	De Bortoli, Lisa Jean, 1968-
Title:	Contextual factors that influence the achievement of Australia's Indigenous students: Results from PISA 2000 - 2006 / Lisa De Bortoli, Sue Thomson.
ISBN:	9780864318701
Subjects:	Programme for International Student Assessment. Educational evaluation--Australia. Aboriginal Australians--Education.
Other Authors:	Thomson, S. (Susan), 1958- Australian Council for Educational Research.
Dewey Number:	371.26

This publication is the result of research that formed part of a program supported by a grant to the Australian Council for Educational Research by Commonwealth, State and Territory governments. The support provided by these governments is gratefully acknowledged.

The views expressed in this report are those of the authors and not necessarily those of the Commonwealth, State and Territory governments.

Contents

Executive Summary

Results from international programs that assess the skills and knowledge of young people have indicated that Australia's Indigenous students perform at a significantly lower level than non-Indigenous students. An in-depth comparison of Indigenous and non-Indigenous students' performance on the Programme of International Student Assessment (PISA) across three cycles is provided in an accompanying volume to this report, while the current report provides an understanding of how various aspects of students' background and psychological constructs relate to each other and to student performance. Chapters 2 through 5 each focus on a different group of potential influences on the performance of students, comparing the profiles of Indigenous and non-Indigenous students, while Chapter 6 presents results of multivariate analyses that assess which factors have a significant impact on the reading, mathematics and scientific literacy of Indigenous students.

Home influences and educational resources in the home

The description of home and educational background factors, as measured in PISA, illustrates the socioeconomic disadvantage faced by many Indigenous students:

- In general, Indigenous students in PISA report lower levels of educational attainment for their parents than non-Indigenous students—fewer Indigenous students have a parent who has completed a university degree and significantly more Indigenous students' parents have completed no more than some secondary school.
- Greater proportions of Indigenous students, compared to non-Indigenous students, live in single parent families or live with a parent and/or a guardian, although the nuclear family remains the most common family arrangement for both Indigenous and non-Indigenous students.
- In terms of access to indicators of family wealth (possessions) and educational resources, fewer Indigenous students compared to their non-Indigenous peers indicated that they had a computer, Internet connection, a desk or textbooks for study.
- The socioeconomic background for Indigenous students had a narrower spread than their non-Indigenous peers and even at the lower levels of socioeconomic background, Indigenous students had greater levels of disadvantage than did non-Indigenous students.
- Although the majority of Indigenous students attended pre-school, fewer Indigenous students than non-Indigenous students reported spending more than one year at pre-school.
- In terms of interruptions or irregularities in school exposure, a greater proportion of Indigenous students reported arriving late for school on a regular basis, and prolonged absences from school occurred more frequently among Indigenous students than non-Indigenous students.

Student attitudes, engagement, motivation and beliefs

Responses to the PISA student questionnaires revealed differences between Indigenous and non-Indigenous students in terms of their attitudes, engagement, motivation and beliefs:

- Indigenous students show significantly lower interest in reading and science than their non-Indigenous peers. No significant differences were found in the levels of interest and enjoyment in mathematics reported by Indigenous and non-Indigenous students.
- Indigenous students were significantly less engaged in reading than non-Indigenous students. Males reported significantly lower levels of engagement in reading than females, regardless of Indigenous status. Interest and engagement in reading is particular low among Indigenous males.

- Indigenous students' appreciation of science, both from a general or personal perspective, was significantly lower than that reported by non-Indigenous students. Indigenous students were also found to have significantly lower levels of instrumental motivation in science than non-Indigenous students.
- There were no significant differences in the effort and persistence Indigenous and non-Indigenous students reported putting into their study.
- Indigenous students reported significantly lower levels of confidence in their abilities to handle tasks effectively than their non-Indigenous peers, with lower levels of self-efficacy in general terms, as well as when self-efficacy was assessed in relation to mathematics and science. Significant gender differences in mathematics self-efficacy were found for both Indigenous and non-Indigenous students, in both cases favouring males.
- Levels of self-concept in mathematics and science for Indigenous students were significantly lower than for non-Indigenous students. Males (regardless of Indigenous status) reported significantly higher levels of self-concept in mathematics and science tasks than female students. There were no significant differences between Indigenous and non-Indigenous students on general academic self-concept.
- Self-efficacy in mathematics and science were found to have one of the strongest associations with student performance among Indigenous and non-Indigenous students alike. Self-concept was also positively related to student performance, more so in mathematics and science than in reading.
- On average, Indigenous students reported significantly higher levels of mathematics anxiety than their non-Indigenous peers.

Students' learning strategies and preferences

Fewer significant differences were found in the ways Indigenous and non-Indigenous students manage their own learning process, the learning strategies they use, or their preferences for different learning situations:

- Indigenous and non-Indigenous students reported using memorisation strategies with similar frequency in general study or when learning mathematics specifically. Females and males used memorisation strategies for learning to a similar extent.
- There were no significant differences between Indigenous and non-Indigenous students' frequency of use of elaboration strategies in general study; however, when elaboration strategies were used specifically in learning mathematics, Indigenous students used this learning strategy less often than their non-Indigenous peers.
- Indigenous and non-Indigenous students were similar in their reported use of control strategies when studying in general, but Indigenous students were less likely to use learning strategies in mathematics that involved checking what they had learned and working out what they still need to learn. In general, female students used control strategies to manage their learning significantly more often than male students.
- Indigenous and non-Indigenous students reported similar preferences for competitive learning situations in learning mathematics and for cooperative learning situations in both a general setting and in learning mathematics.
- Female students, regardless of Indigenous status, reported significantly stronger preferences for cooperative learning situations in general settings compared to males; however, there were no significant differences found by gender for preferring cooperative learning situations in learning mathematics.

The learning environment - schools and classrooms

The lack of significant differences between Indigenous and non-Indigenous students' attitudes towards school, experiences of relationships with teachers, and the disciplinary climate of classrooms is a positive finding, indicating as it does that Australian schools are succeeding in providing a supportive and welcoming environment to all students.

- Indigenous and non-Indigenous students reported similar levels of general engagement with schooling — there were no significant differences in their sense of belonging at school and attitudes towards school.
- Indigenous and non-Indigenous students had similar views about the relationships students have with their teachers. Indigenous and non-Indigenous students held similar views about the level of support their teachers displayed in English and mathematics classes. Male and female indigenous students recorded similar levels of teacher support in the English classroom, but differed in their views of support in the mathematics classroom, with Indigenous females reporting greater support than their male peers.
- Indigenous and non-Indigenous students perceived the disciplinary climate of their English classes to be similar and there were no significant differences in their average scores on this index. Indigenous students reported significantly more disciplinary problems in their mathematics lessons compared to non-Indigenous students. Indigenous males and females did not differ in their views of the disciplinary climate of their English or mathematics classes.

The findings from the analyses described in this report can be categorised in terms of affective behaviours that influence achievement, and student background factors that influence achievement.

In terms of affective behaviours, the analyses show that students who approach learning with confidence, have belief in their abilities, are interested in learning, are motivated, are not anxious about their learning, and who use a range of learning strategies, are more likely to be successful learners and to perform well in the assessments. It is likely that they will also be better able to manage and regulate their learning long after they leave formal education, and that these attributes will ensure that they are equipped to be active citizens. Of great importance for the nation's capacity for redressing the educational inequalities that exist for our Indigenous students will be the challenge to provide educational environments that will foster and encourage these self beliefs, allowing students to develop confidence in their own abilities and take control over their learning in the present and into the future.

The other main findings reflect student background factors. There are still large gaps in the socioeconomic background of Indigenous and non-Indigenous students. Lower levels of attendance at pre-school, lower access to home educational resources and parents with lower levels of experience of education mean that many Indigenous children start school at a disadvantage. Throughout their school lives these problems compound, as Indigenous students are more likely to be late to school on a regular basis, to miss consecutive months of schooling and to change school several times. In national tests in the early years of primary schooling, Indigenous students consistently achieve at lower levels than their non-Indigenous peers, and as schooling continues, the gaps that are there at the beginning of primary school gradually widen as poor attendance compounds a poor start to school. Lower achievement and discontinuity of schooling can lead to lower levels of self-confidence and self-efficacy, which in turn further hinder academic achievement. One of the aims of education is to provide students with opportunities in their lives, and it is important that students and their parents understand the impact of their choices in terms of limiting opportunity. School systems can and should have a role in furthering this understanding.

List of Tables

List of Figures

Reader's Guide

Data underlying the figures

The data referred to in this report and presented in Figures and Tables are available as online documents from the ACER PISA National Website: www.ozpisa.acer.edu.au.

Age of students

The target population is students who were aged between 15 years and 3 (complete) months and 16 years and 2 (complete) months at the beginning of the assessment period, and who were enrolled in an educational institution that they were attending full-time or part-time.

Indigenous status

Indigenous status is derived from students' self-identification as being of Australian Aboriginal or Torres Strait Islander descent. For the purposes of this report, data for the two groups are presented together for Indigenous Australian students.

Socioeconomic background

The measure used to represent elements of socioeconomic background in this report is the highest level of the father's or mother's occupation (known as HISEI), which is coded in accordance with the International Standard Classification of Occupations.

PISA Indices

All indices used in this report were constructed in such a way that the mean for the combined student population from participating OECD countries is set to zero and the standard deviation is set to one; that is, the average OECD student population (e.g. the student with an average level on a particular index) was given an index value of zero and two-thirds of the OECD student population were between the values of -1 and 1.

When interpreting the mean index scores, it is important to be aware that negative values do not necessarily imply that a group of students responded negatively to the underlying items in the index. Rather, a negative value indicates that a group of students responded less positively than all students did, on average, across OECD countries. Similarly, a positive value on an index indicates that a group of students responded more favourably, or more positively, than students did, on average, in OECD countries.

Confidence intervals and standard errors

In this report, descriptive statistics including mean index scores, have been used to describe the characteristics of students. For PISA, each mean index score is calculated from the sample of students who undertook the PISA assessment, and is referred to as the *sample* mean. These sample means are an approximation of the actual mean score, known as the population mean, which would have been derived had *all* students in Australia actually sat the PISA assessment. Since the sample mean is just one point along the range of student scores, more information is needed to gauge whether the sample mean is an underestimation or overestimation of the population mean. The calculation of confidence intervals can assist our assessment of a sample mean's precision as a population mean. Confidence intervals provide a range of scores within which we are ‘confident’ that the population mean actually lies. In this report, sample means are presented with an associated standard error. The confidence interval, which can be calculated using the standard error, indicates that there is a 95 per cent chance that the actual population mean lies within plus or minus 1.96 standard errors of the sample mean. Comparing confidence interval overlap provides an approximate way of comparing the differences between countries, or states, for example, however exact comparisons using t-tests have been used throughout this report.

Correlational analysis

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

The correlation coefficient measures the strength between the two variables. Values of the correlation coefficient can range from -1 (a negative correlation – as one value increases the other decreases) to +1 (a positive correlation – as one value increases the other value increases). In this report, as a rule of thumb, the correlation coefficients have been interpreted as follows:

Correlation coefficient range	Strength of association
$r < -0.30$	strong negative association
$-0.30 < r < -0.15$	moderate negative association
$-0.15 < r < +0.15$	little (weak) or no association
$+0.15 < r < +0.30$	moderate positive association
$r > 0.30$	strong positive association

The statistical significance is indicated by the ‘p-value’. For example, $p < 0.05$ indicates a 95 per cent confidence that the correlation between the two variables is significantly greater than zero.

Chapter 1

Introduction

In 1997, the Organisation for Economic, Cooperation and Development (OECD) launched the Programme for International Student Assessment (PISA). The aim of PISA is to monitor the outcomes of education systems by measuring how well students who are approaching the end of their compulsory schooling are prepared for meeting the challenges they will face in their lives beyond school. The first PISA assessment was carried out in 2000, and has been conducted every three years since then.

The educational indicators that are obtained from each PISA cycle are used to assess differences and similarities both at a point in time and over a period of time. Comparisons can be made between countries or in Australia between states. Key demographic, social and educational influences on student and school performance are also measured in PISA. Due to the collection of this background information, the data also allow detailed analysis and comparison of the performance of Australian Indigenous[1] and non-Indigenous students.

In Australia, the disparity between the educational outcomes of Indigenous and non-Indigenous students are well documented and of great concern. The National Declaration on Educational Goals for Young Australians reports that the educational outcomes for Indigenous students are substantially lower than compared to other students and advised:

> Meeting the needs of young Indigenous Australians and promoting high expectations for their educational performance requires strategic investment. Australian schooling needs to engage Indigenous students, their families and communities in all aspects of schooling; increase Indigenous participation in the education workforce at all levels; and support coordinated community services for students and their families that can increase productive participation in schooling. (MCEETYA, 2008, p. 15)

Hunter and Schwab (2003) investigated the educational disadvantage faced by older Indigenous students. Their research found that the gap in higher education participation rates between Indigenous and non-Indigenous students had widened over time, while the degree of inequality in educational attainment between these two groups increased with the level of qualification. The higher the level of qualification, the fewer Indigenous graduates compared to non-Indigenous graduates.

The National Report on Indigenous Education and Training detailed the serious gaps between Indigenous and non-Indigenous outcomes in education (Commonwealth of Australia, 2002). Results from the Information and Communications Technology (ICT) Literacy, and Civics and Citizenship sample assessments, other national assessments which test the same age group of students, have continued to show that Indigenous students do not perform as well as non-

1 The term 'Indigenous' refers to students who identify as either Australian Aboriginal or Torres Strait Islanders. Please refer to the Reader's Guide.

Indigenous students, with differences being both statistically significant and of a substantial nature (MCEETYA, 2006; 2007).

The educational disadvantage faced by Indigenous students has also been illustrated in PISA. The first volume of this report: *The achievement of Australia's Indigenous students in PISA 2000 – 2006* (De Bortoli & Thomson, 2009), described the educational disadvantage faced by these students. Indigenous students have performed at a substantially and statistically lower average level in reading, mathematical and scientific literacy than their non-Indigenous peers, across all PISA cycles. Table 1.1 shows the performance of Indigenous and non-Indigenous students on each of the major domains, from each PISA cycle. Results for Australia and the OECD average have been included in the table for comparison.

Table 1.1 Achievement in all literacies for Indigenous and non-Indigenous students

Student group	Reading literacy (PISA 2000)		Mathematical literacy (PISA 2003)		Scientific literacy (PISA 2006)	
	Mean	SE	Mean	SE	Mean	SE
Indigenous	448	5.8	440	5.4	441	7.8
Non-Indigenous	531	3.4	526	2.1	529	2.3
Australia	528	3.5	524	2.1	527	2.3
OECD average	500	0.6	500	0.6	500	0.5

The role of contextual factors in understanding the educational gap between Indigenous and non-Indigenous students has been well-documented. Generally, Indigenous people have poorer socioeconomic outcomes than for the non-Indigenous population. This inequality is reflected in lower than average levels of household and individual income and home ownership, and high levels of household overcrowding and homelessness. Furthermore, Indigenous people are less likely to get a pre-school education, are absent from school two to three times more often than other students and their post-school qualification, labour force participation and employment rates are also lower (SCRGSP, 2007).

In terms of academic resilience, Martin and Marsh (2006) examined specific factors that predicted students' academic resilience and found that high self-belief, high control (i.e. the extent to which students feel they are able to avoid failure and achieve success), high persistence, high planning and low anxiety strongly predicted academic resilience. Martin (2006) also focused on the motivation and engagement of Indigenous students and found that there appeared to be divergences in learning styles and that confidence, self-reliance, parental encouragement, positive peer influence, and effective schools (that include well-trained staff and good teacher-student relationships) facilitate Indigenous students' achievement.

PISA assesses student performance as well as collecting data on student, family and school factors, and this information allows for the exploration between data on student learning outcomes and data on students' characteristics. A comprehensive assessment of understanding the performance of Indigenous students in education must encompass the cognitive, affective and attitudinal aspects in addition to academic performance. Volume 1 of this report provided a detailed examination and comparison of the reading, mathematics and scientific literacy of Indigenous and non-Indigenous students. The current volume focuses on Indigenous and non-Indigenous students' personal and family background as well as the influence of psychological factors, including beliefs and attitudes, learning habits and interests that can help to explain differences in performance.

It is important for policy makers to recognise the factors that influence performance in order to address the gaps in student performance between Indigenous and non-Indigenous students, and thus achieve an educational system that provides quality and equity. This report describes the similarities and differences between Indigenous and non-Indigenous students on such constructs as student background, learning strategies, self-related cognitions in mathematics and school climate variables.

Why PISA?

PISA was designed to help governments not only to understand but also enhance the effectiveness of their educational systems. PISA findings are being used internationally to:

- compare literacy skills of students in one country to those of students in other participating countries;
- establish benchmarks for educational improvement, in terms of the mean scores achieved by other countries or in terms of a country's capacity to provide high levels of equity in educational outcomes and opportunities; and
- understand the relative strengths and weaknesses of individual education systems.

PISA's orientation towards the future of these students is reflected in its literacy approach, which is concerned with the capacity of students to apply their skills and knowledge in a particular subject area, and to analyse, reason and communicate effectively as they do so.

PISA in Australia

PISA is a component of Australia's National Assessment Program. Together with the International Association for the Evaluation of Educational Achievement (IEA)'s Trends in International Mathematics and Science Study (TIMSS), PISA provides data from internationally standardised tests that enables Australia to compare its performance to that of other countries. The international measures complement national literacy and numeracy assessments for students in Years 3, 5, 7 and 9 and national sample assessments of Science at Year 6, Civics and Citizenship at Years 6 and 10, and Information and Communications Technology at Years 6 and 10.

Reporting on PISA consists of an international report published by the OECD, and a national report, focussing both on the achievement of Australian students relative to other countries and also for nationally agreed subgroups of the population.

An indicative progress measure based on PISA results has been agreed upon by the Council of Australian Governments (COAG) and is included in the new National Education Agreement as one mechanism to measure progress towards the achievement of outcomes and aspirations for schooling. This elevates the relevance and importance of PISA as a measure of educational attainment in Australia.

The main goals of PISA

Overall, PISA seeks to measure how well young adults, at age 15 and therefore near the end of compulsory schooling in most participating education systems, are prepared to use knowledge and skills in particular areas to meet real-life challenges. This is in contrast to assessments that seek to measure the extent to which students have mastered a specific curriculum. PISA's orientation reflects a change in the goals and objectives of curricula themselves, which increasingly address how well students are able to apply what they learn at school.

As part of the PISA process, students complete an extensive background questionnaire and school principals complete a survey describing the context of education at their school, including the level of resources in the school, qualifications of staff and teacher morale. The reporting of the findings from PISA is then able to focus on issues 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 or 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 the provision of education within a country or across countries?

What skills does PISA assess?

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

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 is also mathematically, scientifically and technologically literate. (OECD, 2000, p. 9)

Major and minor domains

PISA assesses competencies in each of three core domains – reading literacy, mathematical literacy and scientific literacy. During each PISA cycle one domain is tested in detail and is referred to as the 'major' domain. The remaining time is allocated to assessing the other (minor) domains. In 2000, the major domain was reading literacy, with mathematical literacy and scientific literacy making up the minor domains. In 2003, the emphasis moved from reading literacy to mathematical literacy as the major domain. In 2006, the major focus of the assessment was scientific literacy, with reading literacy and mathematical literacy forming the minor domains. The domains covered by PISA are defined in terms of the content that students need to acquire, the processes that need to be performed, and the contexts in which knowledge and skills are applied. The assessments are based on frameworks that provide a common language and a vehicle for discussing the purpose of the assessment and what it is trying to measure. Working groups consisting of subject matter experts were formed to develop the assessment frameworks, which are subsequently considered and approved by the PISA Governing Board (PGB) established by the OECD. These frameworks are revised for the major domain in each cycle.

Student Context Questionnaire

The student questionnaire collected information on the students' background and activities, on their school-related attitudes and on some of their school experiences. The data that are collected from students provides a wealth of information in helping to explore the connections between student performance and factors such as students' socioeconomic background as well as attitudes about school and approaches to learning.

Development of the PISA Questionnaire

The development of the questionnaire items in PISA are guided by a conceptual framework that is created and developed by a group of international experts and agreed to by the PISA Governing Board. The Questionnaire Expert Group (QEG) meets on a regular basis to review developments and to propose future directions. Substantial efforts and resources are devoted to achieving cultural and linguistic appropriateness. Questionnaires were developed through a process of review, evaluation and consultation and further refined by examining field trial data, input from interviews with students, and the developing questionnaire framework.

Coverage of the Questionnaire

The context questionnaire consists of core items which are retained in each PISA cycle. These items concentrate on student characteristics (such as gender, age, year level, country of birth and study program) and home background (including parents' country of birth, language spoken at home, parents' occupational status, parents' educational attainment and items in the home). The remaining items in the PISA questionnaire relate to important aspects of students' attitudes, information about students' experience, motivation for, interest in and engagement with the focus on the major domain for that PISA cycle. In earlier PISA cycles, information about learning strategies and preferences, relationships with teachers and peers, and perceptions of the school and classroom environments were also collected.

Skills for life

Without further follow-up of future educational and occupational outcomes of the students assessed in PISA, it is not 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. More specifically, there is evidence from LSAY that school completion is strongly correlated with PISA achievement outcomes (Hillman & Thomson, 2006). Further evidence from the longitudinal follow-up of students in Canada who participated in the PISA 2000 reading assessment also showed that the PISA performance of students at age 15 was a very strong predictor for a successful transition to higher education at age 19.

How results are reported

International comparative studies have provided an arena to observe the similarities and differences that stem from different educational policies and practices, and have enabled researchers and others to observe what is possible for students to achieve, and which environments are most likely to facilitate their learning. PISA provides regular information on educational outcomes within and across countries by providing insight about the range of skills and competencies, in different assessment domains, that are considered to be essential to an individual's ability to participate and contribute to society.

The results provided in this report include percentages and correlations that are based on students' self-reported behaviours and preferences. Results have also been reported in terms of indices, which summarise student responses to a series of related questions. The items were selected from larger constructs on the basis of established theoretical considerations and previous research. Structural equation modelling was used in the initial data analysis to confirm the theoretically expected results of the indices and to validate their comparability across countries.[2]

Interpreting the PISA indices

The indices were constructed in such a way that the mean for the combined student population from participating OECD countries is set to zero and the standard deviation is set to one; that is, the average OECD student population (e.g. the student with an average level on a particular index) was given an index value of zero and two-thirds of the OECD student population were between the values of -1 and 1.

2 For a description of the details on the methods and reliabilities of the indices, refer to the PISA Technical Report.

When interpreting the mean index scores, it is important to be aware that negative values do not necessarily imply that a group of students responded negatively to the underlying items in the index. Rather, a negative value indicates that a group of students responded less positively than all students did on average across OECD countries. Similarly, a positive value on an index indicates that a group of students responded more favourably, or more positively, than students did, on average, in OECD countries.

Conducting PISA

What do PISA participants do?

Students who participate in PISA complete an assessment booklet that contains questions about one or more of the literacy domains being tested and a Student Questionnaire.

Testing occurs during the morning and students are given two hours to complete the assessment booklet and, following this, 30 to 40 minutes to complete the Student Questionnaire. In PISA 2000, there were 10 assessment booklets, and in PISA 2003 and PISA 2006 there were 13 assessment booklets. The booklets are assembled according to a complex design so that each booklet is linked through common items to other booklets in a balanced way.

In each PISA cycle, all booklets contain items from the major domain, and a rotation system is used to distribute items from the minor domains evenly across the booklets. This distribution of the different items across the booklets means that a broader range of tasks can be assessed in the same amount of time, as well as enhancing the validity of the administration as students are unlikely to be doing the same booklet as students around them. Item Response Theory is used to link common items from the different booklets.

The Student Questionnaire, which is the same across all participating countries, collects information on students and their family background, aspects of learning and instruction in the major domain of assessment for that cycle, and the context of instruction, including instructional time and class size.

The School Questionnaire, answered by the principal (or the principal's designate), collects descriptive information about the school and information about instructional practices. For example, questions are asked about qualifications of teachers and numbers of staff, teacher morale, school and teacher autonomy, school resources, and school policies and practices, such as use of student assessments.

In Australia, a National Advisory Committee guides all aspects of the project. The National Project Manager is responsible for the implementation of PISA at the national level. Prior to the beginning of the first round of PISA, the National Advisory Committee recommended a process of oversampling Indigenous students to reliably report results for this minority group. ACER (the National Project Manager in Australia) liaises with schools to gain their participation and help with the logistics of arranging assessment sessions.

Who participates in PISA?

Countries

PISA was originally an OECD assessment, created by the governments of OECD countries. The first PISA assessment of 15-year-old students in 2000 took place in 28 OECD countries (including Australia) and four non-OECD (or partner) countries. Since then, it has become a major assessment tool in many regions and countries around the world. In 2001, 11 partner countries repeated PISA 2000. In 2003, more than one-quarter of a million students from 41 countries (all 30 OECD member countries and 11 non-OECD countries) participated in PISA, and in 2006, almost 400,000 students from 57 countries (all OECD countries and 27 partner countries) took part in the assessment.

Schools

In most countries 150 schools and 35 students in each school are randomly selected to participate in PISA. In some countries, including Australia, a larger sample of schools and students participate. This allows countries to carry out specific national options at the same time as the PISA assessment, or for meaningful comparisons to be made between different sectors of the population.

In Australia, a larger sample of schools and students is gathered for three main reasons:

- To allow comparison between the States and Territories. It is necessary to 'oversample' the smaller states because a random sample proportionate to state populations would not yield sufficient students in the smaller states to give a result that would be sufficiently precise;
- To allow examination of Indigenous student performance. A special focus in PISA in Australia has been to ensure that there is a sufficiently large sample of Australia's Indigenous students, so that valid and reliable analysis can be conducted separately; and
- To allow for longitudinal follow-up of participating students. The PISA 2003 and 2006 samples became a cohort of the Longitudinal Surveys of Australian Youth (LSAY). These students are tracked and contacted in future years to trace their progress through school and entry into further education and the work force. A large sample is needed to allow for attrition: over time a proportion of the original sample is not able to be traced or chooses to leave the study.

In PISA 2000 there were 231 schools in the achieved Australian sample. In PISA 2003 and PISA 2006 the sample of schools increased to 321 and 356, respectively. The Australian school sample is designed so that schools are selected with a probability proportional to the enrolment of 15-year-olds in each school. Stratification ensures the correct ratios of government, Catholic and independent sectors.

The PISA participating schools were also stratified with respect to the MCEETYA Schools Geographic Location Classification. In PISA 2000, 69 per cent of the schools were located in the metropolitan zone, 30 per cent were from provincial zones and one per cent of schools were in remote areas. Similar proportions of schools were selected for PISA 2003, with 72 per cent of schools located in metropolitan zones, 27 per cent from provincial zones and one per cent in remote locations. In PISA 2006, 65 per cent of schools were located in the metropolitan zone, 30 per cent from provincial zones and around five per cent of schools were in remote areas.

Students

The target population for PISA is students who are 15-years-old and enrolled at an educational institution, either full- or part-time, at the time of testing. From each country, a random sample of 35 students is selected with equal probability from each school using a list of all 15-year-old students that is submitted by the school. Schools were requested to provide information such as date of birth, sex and year level, as well as Indigenous status for their 15-year-old students.

In PISA 2000, 35 students were randomly selected from each Australian school and in PISA 2003 and PISA 2006 the Australian student sample was increased to 50 students per school (for the reasons described earlier). In addition to the general increase in sample size, to ensure the Indigenous sample was as large as possible, all age eligible Indigenous students from all participating schools were asked to participate in PISA.

The Australian student sample was drawn representatively from all states and sectors. Table 1.2 shows the number of participating students in PISA 2000, PISA 2003 and PISA 2006, along with the size of the underlying population.

Table 1.2 Number of Australian PISA Students

PISA	Sample N	Population N
2000	5 477	228 331
2003	12 551	235 593
2006	14 170	234 938

Table 1.3 shows the number of Indigenous and non-Indigenous students who participated in PISA. To provide some context, the Australian Bureau of Statistics (2007) reported the estimated resident Indigenous population of Australia for 2006 at 2.5 per cent of the total population.

Table 1.3 Number of Indigenous and non-Indigenous students in PISA 2000, PISA 2003 and PISA 2006

PISA	Indigenous Students			Non-Indigenous Students	
	Sample N	Population N	Weighted %	Sample N	Population N
2000	493	5 440	2.4	4 984	222 892
2003	815	5 193	2.2	11 736	230 398
2006	1080	6 891	2.9	13 090	228 049

In PISA 2000, there was a slight gender imbalance across the entire sample of students, with 53 per cent of the sample being male. In PISA 2003 and again in PISA 2006, the magnitude of the gender imbalance was almost negligible, with 51 per cent of the sample male students. Among participating Indigenous students, there were similar numbers of male and female students in each cycle. Table 1.4 provides a breakdown of Indigenous and non-Indigenous students by gender for each PISA cycle.

Table 1.4 Number of Indigenous and non-Indigenous students by gender in PISA 2000, PISA 2003 and PISA 2006

PISA	Indig. Females %	Indigenous students				Non-Indig Females %	Non-Indigenous students			
		Females		Males			Females		Males	
		Sample N	Population N	Sample N	Population N		Sample N	Population N	Sample N	Population N
2000	51	256	2 772	237	2 667	47	2 393	105 462	2 591	117 430
2003	47	400	2 462	415	2 730	49	5 816	113 366	5 920	117 032
2006	49	537	3 405	543	3 486	49	6 441	111 387	6 649	116 662

As the sample is age-based, the students may be enrolled in different year levels, although the majority are in Years 9, 10 and 11. There are some variations to the year-level composition of the sample because of differing school starting ages in the different states. Table 1.5 shows the percentage of Indigenous and non-Indigenous students at each year level.

Table 1.5 Distribution of Indigenous and non-Indigenous students by year level in PISA 2000, PISA 2003 and PISA 2006

PISA	Indigenous students					non-Indigenous students				
	Year level#€ (%)									
	8	9	10	11	12	8	9	10	11	12
2000	€	7	74	19	0	€	7	76	17	0
2003	€	10	74	16	€	€	8	72	19	€
2006	€	9	59	32	0	€	9	71	20	€

\# Totals may not add up to 100 because of rounding.
€ Percentage ≤ 0.2

In PISA 2006, there was were more Indigenous students in Year 11 and fewer Indigenous students in Year 10 than in PISA 2000 and PISA 2003. Further investigation showed that there were 23 per cent of age-eligible Indigenous students in Year 11 in PISA 2006 compared to 12 per cent in PISA 2003.

In PISA 2000 and PISA 2003, almost all of the Indigenous students sampled were from schools in metropolitan and provincial locations with very few from schools in remote areas. In PISA 2006, however, a higher proportion of Indigenous students in the sample were from schools in remote areas (Table 1.6).

Table 1.6 Distribution of Indigenous students by geographic location in PISA 2000, PISA 2003 and PISA 2006

PISA	Geographic location (%)		
	Metropolitan	Provincial	Remote
2000	44	54	2
2003	50	49	2
2006	37	44	19

Table 1.7 shows the distribution of Indigenous students by socioeconomic background in PISA. Socioeconomic quartiles are defined on the whole population, so the distribution of Indigenous students' scores should be approximately the same across quartiles; however, the table shows that Indigenous students are overrepresented in the lowest quartile of socioeconomic background and underrepresented in the highest quartile.

Table 1.7 Distribution of Indigenous students by socioeconomic background in PISA 2000, PISA 2003 and PISA 2006

PISA	Socioeconomic status (%)			
	Lowest quartile	Second quartile	Third quartile	Highest quartile
2000	37	29	20	13
2003	41	22	22	14
2006	44	24	23	10

Organisation of this report

Australia's Indigenous students perform at a significantly lower level than non-Indigenous students on PISA. This report provides an understanding of how various aspects of students' background and psychological constructs relate to each other and to student performance. Chapter 2 focuses on home and educational resources in the home. Chapter 3 investigates attitudes, engagement, motivation and beliefs. Chapter 4 presents information about students' learning strategies and preferences, and Chapter 5 looks at the learning environment. Chapter 6 presents multivariate analyses aimed at investigating the relationships between the contextual constructs and achievement in each PISA cycle, and the final chapter, Chapter 7, provides a summary of the report and some implications for policy.

Chapter

2

Home and educational background

Key findings

- Indigenous students with a socioeconomic background in the highest quarter on the HISEI scored 36 points higher, on average, on the mathematics assessment than Indigenous students in the lowest quarter.
- Indigenous students are faced with greater levels of socioeconomic disadvantage than non-Indigenous students, and the range of socioeconomic backgrounds is narrower for Indigenous students than for non-Indigenous students.
- Socioeconomic background has less of an effect on the performance of Indigenous students than non-Indigenous students, however as the performance of all Indigenous students is low, it is unclear whether this is a positive finding.
- Indigenous students reported lower levels of educational attainment for their parents than non-Indigenous students. Twice as many non-Indigenous students as Indigenous students reported at least one parent who had completed a university degree.
- The most common family structure for Indigenous and non-Indigenous families is the nuclear family, however, there were more Indigenous than non-Indigenous students living in single parent or mixed families.
- Indigenous students reported having fewer items related to family wealth and home educational resources than non-Indigenous students.
- Although the majority of Indigenous students attended pre-school, a lower proportion of Indigenous than non-Indigenous students attended pre-school for more than one year.
- A higher proportion of Indigenous than non-Indigenous students missed extended periods of school. Seven per cent of Indigenous students reported missing two or more consecutive months of secondary school on two or more separate occasions.

It is well known that there are many background factors that influence student achievement. Although the constructs described in this chapter cannot be altered directly, policy makers, through effective policies, can make efforts to mitigate the negative impact of such background factors on student performance to achieve equitable learning opportunities.

The first part of this chapter describes some of the findings related to home background, such as parent's occupational status and home educational resources, from data that have been gathered in PISA. The second part of the chapter focuses on factors associated with educational backgrounds and covers participation in pre-school and regularity of school attendance.

Parents' occupational status

Students were asked to report their mothers' and fathers' occupations as part of the Student Questionnaire in each cycle of PISA. The open-ended responses were coded in accordance with the International Standard Classification of Occupations (ISCO), and the resulting classifications were then used to derive a measure on the PISA International Socioeconomic Index of Occupational Status. This index captures the attributes of occupations that relate parental occupation to income and is thus taken as a measure of socioeconomic status. In PISA, the value of the index (HISEI) is based on whichever of the father's or mother's occupation has the highest status. Values on the HISEI range from 0 to 90, with higher values representing higher socioeconomic status and lower values represent lower socioeconomic status. The mean HISEI values for Indigenous and non-Indigenous students in PISA 2000, 2003 and 2006 are shown in Table 2.1. The mean HISEI for Indigenous students is statistically significantly lower than that of their non-Indigenous counterparts in each cycle of PISA.

Table 2.1 HISEI means and standard errors for Indigenous and non-Indigenous students

PISA	Indigenous students		Non-Indigenous students	
	Mean	SE	Mean	SE
2000	46.1	1.1	52.3	0.5
2003	46.0	0.7	52.7	0.3
2006	45.9	0.6	53.2	0.3

For Indigenous students, there were moderate correlations between HISEI and student performance in reading ($r = 0.15$ in PISA 2000), scientific literacy ($r = 0.15$ in PISA 2006), and mathematical literacy ($r = 0.19$ in PISA 2003). Among non-Indigenous students, the correlations between HISEI and student performance across each of the three domains/cycles (reading, mathematical and scientific literacy) were moderate, at around 0.31. These positive correlations indicate that a student's score in each of the domains increases with an increase in their HISEI score.

Throughout this report, figures showing the relationship between the quartiles of an index (obtained by dividing scores on the index into quarters) and the average performance for students are shown to provide further information. Figure 2.1 shows the relationship between HISEI quartiles and mathematical literacy performance for Indigenous and non-Indigenous students (PISA 2003). Indigenous students with a socioeconomic background in the highest quarter on the HISEI scored, on average, 36 points higher than Indigenous students with HISEI values in the lowest quartile. Among non-Indigenous students, the difference between average mathematical literacy scores of students with HISEI values in the highest and lowest quartiles was much larger; at 78 score points, this difference was almost twice that found among Indigenous students.

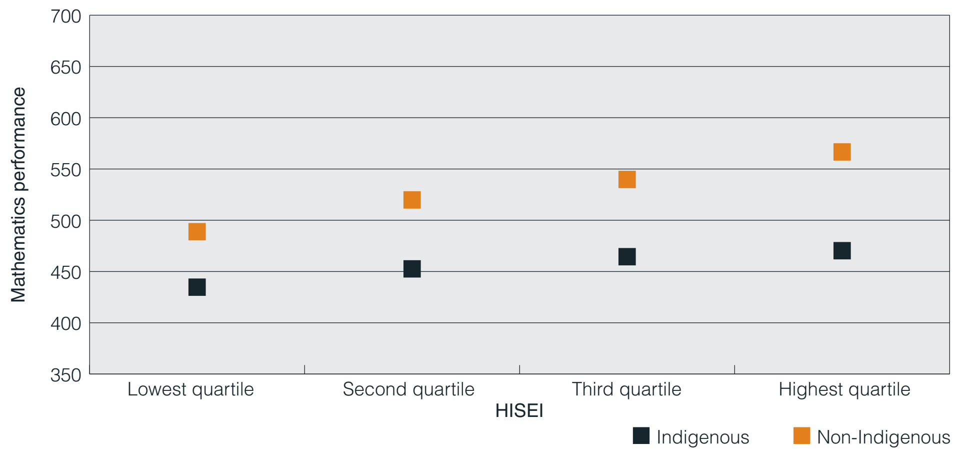

Figure 2.1 Mean mathematical literacy performance scores by quartiles on HISEI, Indigenous and non-Indigenous students

Socioeconomic gradients[3]

The terms 'socioeconomic gradient' or 'social gradient' refer to the relationship between an outcome and socioeconomic background. In the case of PISA, the outcome in question is students' performance and the measure of socioeconomic performance is the HISEI index.[4]

The results presented in the previous section indicate that there is a significant relationship between students' performance and their socioeconomic background as measured by HISEI. This relationship is evident for Indigenous and non-Indigenous students; however the impact of socioeconomic background on performance shows a different relationship for each of these groups.

In a graphical representation, the line of best fit for the points on the scatterplot representing performance against socioeconomic background (HISEI) is referred to as the social gradient, and provides useful information about several aspects of the relationship.

- The *slope* of the gradient line is an indication of the extent of inequality in the relationship between students' results and their socioeconomic background (as measured by HISEI). A steeper slope indicates a greater difference in performance between low socioeconomic background students and high socioeconomic background students. Education systems typically aim to decrease the differences in performance between different social groups. Greater equity would thus be indicated by a flatter gradient.
- The average *level* of the line in the graph gives an indication of how well the overall population has achieved on the given assessment. Lines at higher levels indicate higher mean performance by the students.
- The *length* of the line indicates the range of HISEI. The graphs in this chapter are plotted between the 5th percentile of HISEI and the 95th percentile of HISEI; that is, the graphs span the middle 90 per cent of the values of HISEI for Australia overall and for Indigenous and non-Indigenous students. A smaller range indicates less difference in socioeconomic background between students from the highest and lowest socioeconomic backgrounds in the group of students. The range can be measured by projecting the starting point and finishing point of the gradient onto the horizontal axis.

The graph in Figure 2.2 shows the socioeconomic gradient for Indigenous and non-Indigenous students in scientific literacy performance for PISA 2006. Graphically, the relationship between socioeconomic gradients and reading or mathematical literacy performance are very similar to this, so only one figure is shown here. The vertical axis represents scores on the overall scientific literacy scale. The horizontal axis represents socioeconomic background as measured by HISEI.

The socioeconomic gradients for Australia overall and for non-Indigenous students are very similar (and would be expected to be similar given the majority of Australian students are from a non-Indigenous background), and the slope of the graph indicates that non-Indigenous students from more advantaged socioeconomic backgrounds (i.e., higher HISEI) perform better, on average, than those from disadvantaged backgrounds. This can be seen from the upwards slope of the line, and at a coarser level in Figure 2.1. The socioeconomic gradient also suggests that the difference in student performance associated with a particular change in socioeconomic background is about the same throughout the distribution of socioeconomic background.

The socioeconomic gradient for Indigenous students is flatter, indicating that while students from more advantaged socioeconomic backgrounds generally perform better than those from disadvantaged backgrounds, this effect is not as pronounced as for non-Indigenous students. This

3 Notes for this section have been adapted from the National 2006 publication, *Exploring Scientific Literacy: How Australia measures up. The PISA 2006 survey of students' scientific, reading and mathematical literacy skills.*

4 HISEI has been used in this chapter as the measure of socioeconomic background (instead of the economic, social and cultural status (ESCS) index) because results are presented across PISA cycles.

is illustrated by the divergence of the non-Indigenous and Indigenous social gradients as HISEI increases.

Another difference between Indigenous and non-Indigenous students is the length of the socioeconomic gradient, which indicates how widely the student population is dispersed in terms of socioeconomic background. The range of socioeconomic background scores between the 5th and 95th percentiles is smaller for Indigenous students than non-Indigenous students. The starting point of the socioeconomic gradient for Indigenous students is slightly to the left than that of non-Indigenous students, indicating that there are Indigenous students living in greater levels of poverty than any non-Indigenous students. Conversely, the socioeconomic gradient for non-Indigenous students extends much further to the right than that for Indigenous students, indicating that there are non-Indigenous students in much more affluent homes than any Indigenous students.

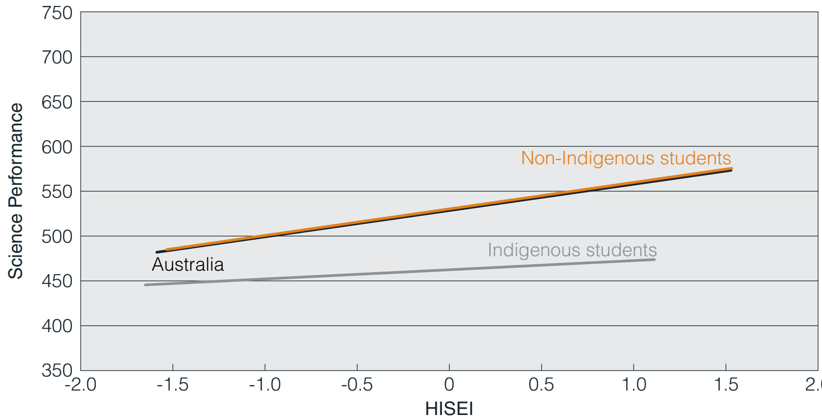

Figure 2.2 Socioeconomic gradient for Indigenous and non-Indigenous students, and for Australian students overall for scientific literacy in PISA 2006

Parents' educational attainments

Parental education is a family background variable that is often used in the analysis of educational outcomes. Students were asked to identify the highest level of education of their mother and father by answering two questions, which were phrased slightly differently in PISA 2000 than in PISA 2003 or PISA 2006.

In PISA 2000, information about parents' educational attainment was collected using the questions and categories shown below. Categories of education levels were coded in accordance with the International Standard Classification of Education (ISCED) and the corresponding ISCED levels for each category have been included in brackets.

Did your father/mother complete secondary school (Year 12)?

- No, he/she did not go to school
- No, he/she completed primary school only (ISCED Level 1)
- No, he/she completed some secondary school, but not more than Year 10 (ISCED Level 2)
- No, he/she completed Year 10 or Year 11 and then did some training courses (e.g., business studies, apprenticeship, nursing) (ISCED Level 3B or 3C)
- Yes, he/she completed Year 12 (ISCED Level 3A)

Did your father/mother complete a university degree?

- Yes (ISCED Level 5A, 5B or 6)
- No

Figure 2.3 shows the proportion of Indigenous and non-Indigenous students in PISA 2000 by level of parental education.[5] Forty-five per cent of non-Indigenous students, compared to 22 per cent of Indigenous students, reported that their parents' highest level of education was a university degree, while similar proportions of Indigenous and non-Indigenous students reported that their parents' highest level of education was Year 12 (24 and 25 per cent, respectively). Twice the proportion of Indigenous students as non-Indigenous students reported that neither parent had completed secondary school.

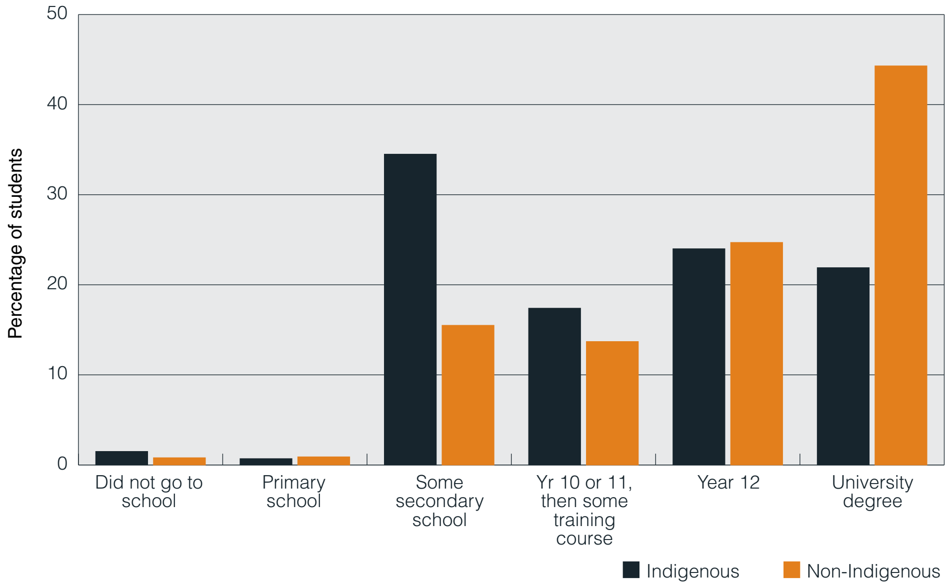

Figure 2.3 Indigenous and non-Indigenous students' reports of their parents' educational attainments, PISA 2000

In PISA 2003 and 2006, information about the educational attainment of students' parents was collected using the questions and categories shown below. Again, the corresponding ISCED levels for each category have been included in brackets.

Which of the following did your father/mother complete at school?

- He/she completed Year 12 (ISCED Level 3A)
- He/she completed Year 10 or 11 and then did a TAFE training certificate (ISCED Level 3B or 3C)
- He/she completed some secondary school, but not more than Year 10 (ISCED Level 2
- He/she completed primary school only (ISCED Level 1)
- None of the above

Does your father/mother have any of the following qualifications?

- A university degree (ISCED Level 5A, 6)
- A TAFE diploma (ISCED Level 5B)
- A TAFE training certificate (ISCED Level 4)

Similar to the findings in PISA 2000, 40 per cent of non-Indigenous students, compared to 20 per cent of Indigenous students, reported that their parents' highest level of education was a university degree, while similar proportions of Indigenous and non-Indigenous students reported that their parents' highest level of education was a TAFE diploma (around 15 per cent of students). A further 40 per cent of Indigenous students and 30 per cent of non-Indigenous students reported that Year 12 or a TAFE training certificate was the highest level of parental education. Around 15 per cent of

5 Highest educational level of the student's mother and father

Indigenous students and 10 per cent of non-Indigenous students reported that neither parent had completed secondary school (Figure 2.4).

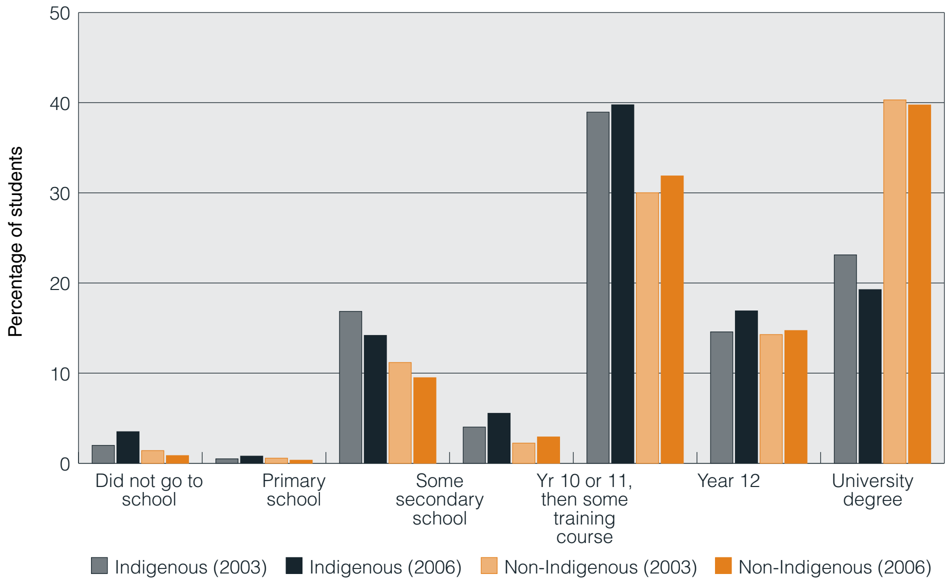

Figure 2.4 Indigenous and non-Indigenous students' reports of their parents' educational attainments, PISA 2003 and PISA 2006

Among Indigenous students, there was little association between the educational attainment of parents and the students' performance in reading literacy (PISA 2000) or mathematical literacy (PISA 2003), with non-significant correlations in both cycles ($r = 0.07$ and 0.06, respectively). The correlation between parents' educational attainment and students' scientific literacy performance in 2006 was moderate ($r = 0.20$). The relationship between parents' education and student performance was also moderate amongst non-Indigenous students, with correlations of 0.28 for reading literacy (PISA 2000), 0.23 for mathematical literacy (PISA 2003) and 0.25 for scientific literacy (PISA 2006). It is unclear why the association is weaker among Indigenous students.

Family structure

Students who participated in PISA 2000 and 2003 were asked who usually lived at home with them, and their responses to this question were grouped into four categories:

- nuclear family (student lives with a mother and a father);
- single parent family (student lives with one of mother, father, female or male guardian);
- mixed family (student lives with mother and male guardian, father and female guardian or two guardians); and
- other family combinations (including living with other relatives).

As shown in Figure 2.5, the most common family arrangement for both Indigenous and non-Indigenous students was a nuclear family, with close to half of the Indigenous students (48% in PISA 2000 and 42% in PISA 2003) and around three-quarters of the non-Indigenous students (73% in PISA 2000 and 70% in PISA 2003) living in such a family. A greater proportion of Indigenous students than non-Indigenous students reported living in single parent families: one-quarter of Indigenous students in PISA 2000, and almost one-third of Indigenous students in PISA 2003, compared to close to one sixth of non-Indigenous students in PISA 2000, and one-fifth of non-Indigenous students in PISA 2003. Thirteen per cent of Indigenous students and three per cent of non-Indigenous students reported living in other family combinations, which included living with relatives other than their parents.

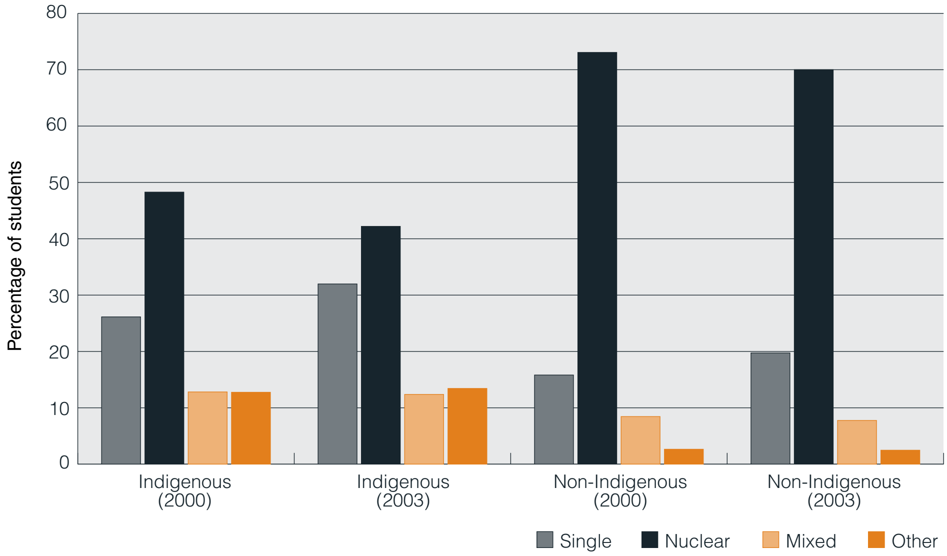

Figure 2.5 Indigenous and non-Indigenous students' reports of family structure, PISA 2000 and 2003

On average, reading literacy performance from PISA 2000 was similar for Indigenous students who lived in single parent families, nuclear families or mixed families. Students who lived in other family combinations were found to perform at a lower level. The pattern between different types of family structures and reading literacy performance was for non-Indigenous students were alike to that for Indigenous students. The results between mathematical literacy performance in PISA 2003 and family structure were similar to that for reading literacy performance in PISA 2000 (Figure 2.6).

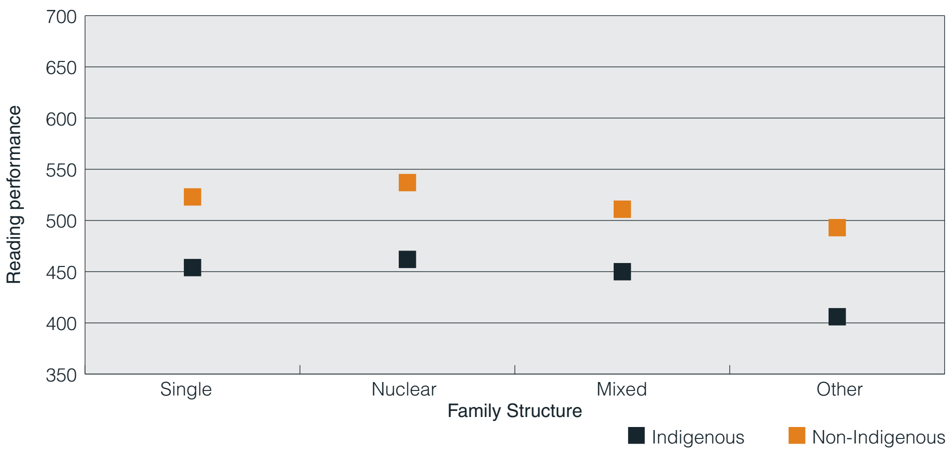

Figure 2.6 Mean reading literacy performance scores by family structure, for Indigenous and non-Indigenous students

Family Wealth

In PISA 2000 and 2006, indications of family wealth were collected using information about items in the home. Students were asked two questions about possession of specific items in the home and about the quantity of some of these items.

In PISA 2000, family wealth was based on students' reports on:

1. the availability, in their home, of:
   - a dishwasher,
   - a room of their own,
   - educational software, and
   - a link to the Internet.
2. the number of:
   - mobile phones,
   - televisions,
   - computers,
   - cars, and
   - bathrooms in the home.

While the majority of both Indigenous and non-Indigenous students indicated they have a room of their own, at least one television in their home or at least one car in the family, there were differences in the proportions of Indigenous and non-Indigenous students who reported owning other indicators of family wealth (Table 2.2). Two-thirds of the participating Indigenous students lived in homes with one bathroom while over half of non-Indigenous students lived in homes with two or more bathrooms. One-third of Indigenous students, compared to half the non-Indigenous students, reported having a dishwasher in their home. Seventy-five per cent of Indigenous students reported having at least one mobile phone in the home compared to almost ninety per cent of non-Indigenous students.

A similar proportion (approximately half) of Indigenous and non-Indigenous students indicated they had a computer in the home; however, one in three Indigenous students, compared to one in ten non-Indigenous students, reported that they did not have access to a computer at home. The proportion of Indigenous students who reported having a link to the internet in their home was almost half that of non-Indigenous students with such access. A smaller proportion of Indigenous students (62%) than non-Indigenous students (82%) had educational software available for them at home.

Table 2.2 Percentage of Indigenous and non-Indigenous students reporting access to family wealth items, PISA 2000

Family wealth items	PISA 2000					
	Indigenous students			Non-Indigenous students		
a dishwasher	28			54		
a room of their own	83			90		
educational software	62			82		
a link to the Internet	36			68		
	None	One	Two or more	None	One	Two or more
Mobile phone(s)	26	31	43	13	30	58
Television(s)	<1	16	83	1	13	86
Computer(s)	35	47	18	8	54	37
Car(s)	11	35	54	4	22	77
Bathroom(s)	2	66	32	2	39	59

In PISA 2006, family wealth was based on students' reports on:

1. the availability, in their home, of:
   - a dishwasher,
   - a room of their own,
   - a link to the Internet,
   - a DVD or VCR player,
   - cable/pay TV,
   - a digital camera, and
   - a plasma TV.
2. the number of:
   - mobile phones,
   - televisions,
   - computers, and
   - cars in the home.

Again, in PISA 2006, Indigenous students reported having fewer items related to family wealth than non-Indigenous students, although there were some increases between PISA 2000 and PISA 2006 in the proportion of Indigenous students reporting having some items.

Almost all Indigenous and non-Indigenous students had a DVD or VCR player in their home and most students had a room of their own and a family car. The majority of both Indigenous and non-Indigenous students reported having at least one mobile phone and at least one television in their home. Interestingly, there were more Indigenous than non-Indigenous students who reported having cable or pay television, while similar proportions of Indigenous and non-Indigenous students reported having a plasma TV in their home.

Access to the Internet was more common among Indigenous students in PISA 2006 than in previous years, with two-thirds indicating they had a link to the Internet at home. Among non-Indigenous students, access to the Internet was even greater, with over 90 per cent reporting having access at home. Only three per cent of non-Indigenous students, compared to 17 per cent of Indigenous students, reported not having a computer in their home (Table 2.3).

Table 2.3 Percentage of Indigenous and non-Indigenous students reporting access to family wealth items, PISA 2006

Family wealth items	PISA 2006					
	Indigenous students			Non-Indigenous students		
a dishwasher	38			67		
a room of their own	89			93		
a link to the Internet	67			93		
a DVD or VCR player	97			99		
Cable/pay TV	58			44		
Digital camera	76			88		
Plasma TV	35			36		
	None	One	Two or more	None	One	Two or more
Mobile phone(s)	2	6	92	1	3	96
Television(s)	1	8	91	1	7	92
Computer(s)	17	52	32	3	37	60
Car(s)	8	27	65	2	19	80

The items listed in Tables 2.2 and 2.3 were used to create an index of family wealth for PISA 2000 and PISA 2006. In PISA 2000, the mean for Indigenous students on the family wealth index was below the OECD average at -0.26 and was significantly lower than the mean of 0.44 for non-Indigenous students. The mean index scores in PISA 2006 for family wealth were also significantly different with means of -0.03 and 0.41 for Indigenous and non-Indigenous students, respectively. Figure 2.7 shows the means on the family wealth index graphically.

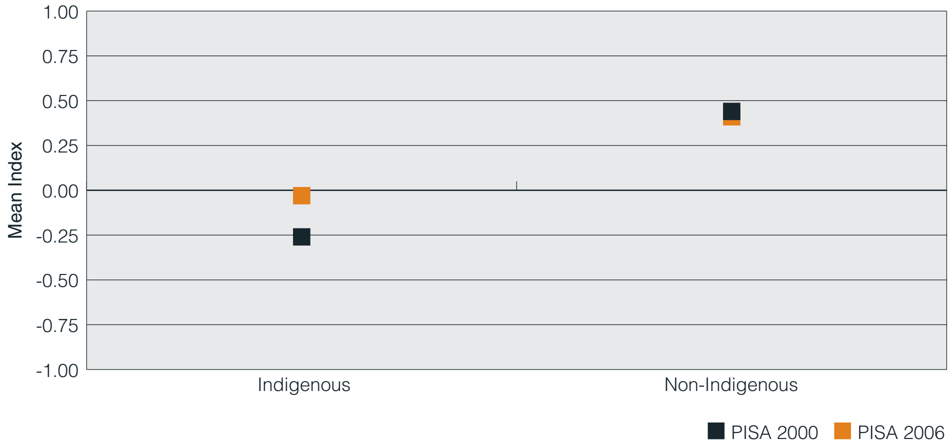

Figure 2.7 Indigenous and non-Indigenous students' reports of levels of family wealth, PISA 2000 and 2006[6]

For Indigenous students, family wealth was moderately correlated with reading literacy performance (r = 0.21) and scientific literacy performance (r = 0.24). For non-Indigenous students, the association between family wealth and reading literacy performance was weak with a correlation of 0.13, however this was higher than the association between family wealth and scientific literacy performance of 0.01. Figure 2.8 shows the relationships between family wealth and scientific literacy performance (PISA 2006) for Indigenous and non-Indigenous students. For non-Indigenous students, the graph is almost flat, indicating that family wealth has little impact on performance in scientific literacy. For Indigenous students, the graph has a positive slope, indicating that as the levels of family wealth increase, so does the level of scientific literacy performance. The graph also shows that the difference in scientific literacy performance between Indigenous and non-Indigenous students is greater for those students at the lowest quartile of family wealth than for those Indigenous and non-Indigenous students at the highest quartile of family wealth.

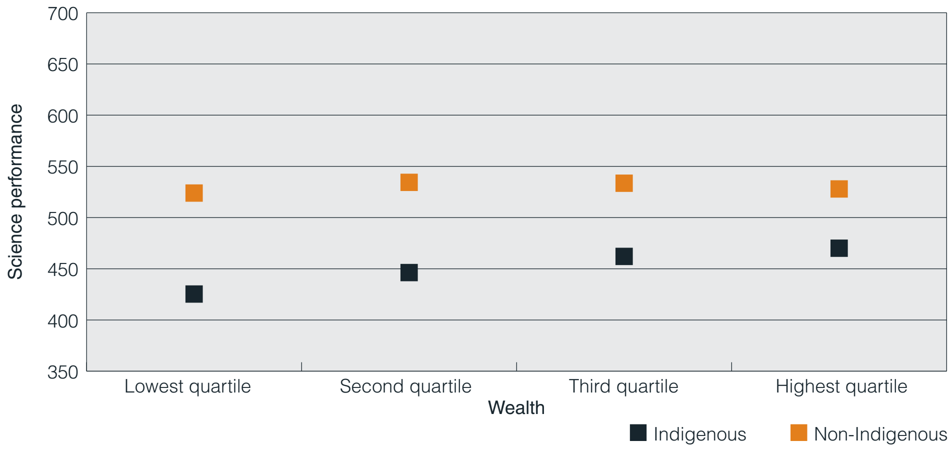

Figure 2.8 Mean scientific literacy performance scores by quartiles on the family wealth index, for Indigenous and non-Indigenous students

6 A summary table of all indices is provided in Appendix A.

Home educational resources

In each PISA cycle, students are asked questions about their access to educational resources at home, with slightly different items used in PISA 2000 to those used in the later cycles.

PISA 2000 measured students' home educational resources based on the availability in their home of the following items:

- a dictionary,
- a quiet place to study,
- a desk for study,
- school textbooks, and
- the number of calculators in the home.

Table 2.4 shows that the majority of Australian students had good access to educational resources in the home. There were some differences in the levels of access of Indigenous and non-Indigenous students, with a lower proportion of Indigenous than non-Indigenous students having a desk or a quiet place for study, or having access to school textbooks at home.

Table 2.4 Percentage of Indigenous and non-Indigenous students reporting access to home educational resources in PISA 2000

Home educational resource items	PISA 2000	
	Indigenous students	Non-Indigenous students
a desk for study	80	90
a quiet place to study	84	90
school textbooks	81	93
a dictionary	94	99
one or more calculators	98	99

PISA 2003 and 2006 measured students' home educational resources based on the home availability of the following items:

- a desk for study,
- a quiet place to study,
- own calculator,
- books to help with school work, and
- a dictionary.

A similar picture to that seen in PISA 2000 was found in PISA 2003 and PISA 2006, with a lower proportion of Indigenous students than non-Indigenous students having access to a desk or a quiet place for study, or books to help with their school work (Table 2.5).

Table 2.5 Percentage of Indigenous and non-Indigenous students reporting access to home educational resources in PISA 2003 and PISA 2006

Home educational resource items	PISA 2003		PISA 2006	
	Indigenous students	Non-Indigenous students	Indigenous students	Non-Indigenous students
a desk for study	79	91	77	93
a quiet place to study	75	84	80	90
own calculator	91	97	92	98
books to help with school work	73	81	76	86
a dictionary	91	98	92	98

An index of home educational resources was constructed for each of the PISA cycles using these items. Positive values on the index indicate higher levels of home educational resources. Across all PISA cycles, the mean score on this index for Indigenous students was significantly lower than the mean for non-Indigenous students. In PISA 2000, the mean index score for Indigenous students on the home educational resources index was -0.63, compared to the mean for non-Indigenous students of 0.07. In PISA 2003, the mean index scores for Indigenous and non-Indigenous students were -0.32 and 0.11, respectively, and in PISA 2006 Indigenous students recorded a mean index score of -0.53 compared to 0.06 for non-Indigenous students (Figure 2.9).

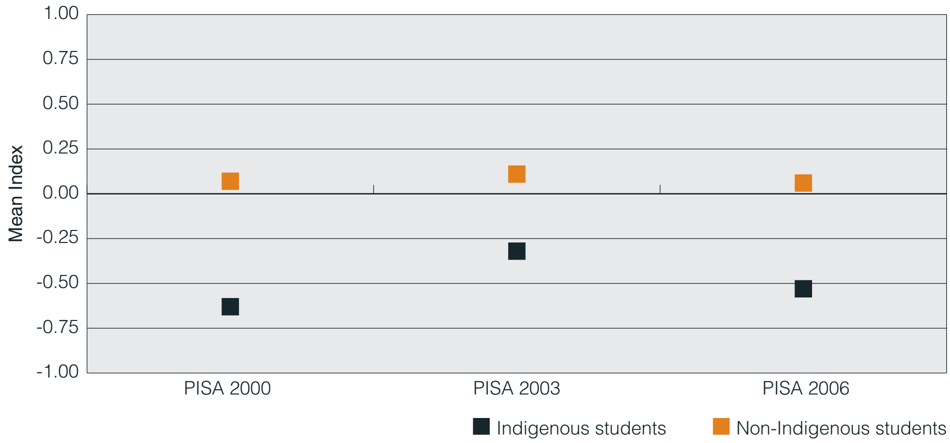

Figure 2.9 Level of home educational resources in PISA 2000, 2003 and 2006 reported by Indigenous and non-Indigenous students

The relationships between educational resources in the home and performance in reading literacy and scientific literacy were quite similar, with strong correlations of 0.37 and 0.39 for Indigenous students, and moderate correlations of 0.21 and 0.17 for non-Indigenous students (reading literacy and scientific literacy, respectively). The association between educational resources in the home and performance in mathematical literacy was the same for Indigenous and non-Indigenous students, with a moderate correlation of 0.22.

Figure 2.10 shows the relationship between quartiles of home educational resources and students' reading literacy performance. Among Indigenous students, there was a 64 point difference between the average scores of students in the highest and lowest quartiles on the home educational resources index. Among non-Indigenous students, those in the highest quartile scored 34 points higher on average on the reading literacy assessment than students in the lowest quartile of the home educational resources index.

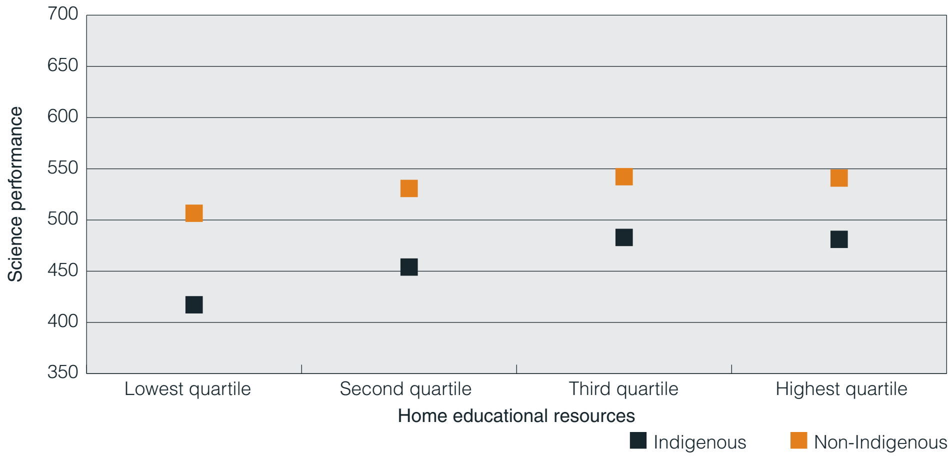

Figure 2.10 Mean reading literacy performance scores by quartiles on the home educational resources index, for Indigenous and non-Indigenous students

Pre-school attendance

There are a number of educational benefits for children who attend pre-school (for example Horton, 1997). In PISA 2003, students were asked whether they attended pre-school[7], and for those students who did, whether they attended for one year or less, or for more than one year.

The majority of Indigenous students in PISA 2003 reported that they had attended pre-school. Of the 90 per cent of Indigenous students who had attended pre-school, the majority attended for just one year (although a little more than one-third of Indigenous students attended for more than one year). This contrasts with the experience of non-Indigenous students – a greater proportion of whom attended pre-school in the first instance, and about the same proportion (just under one-half) attended for one year and more than one year (Figure 2.11).

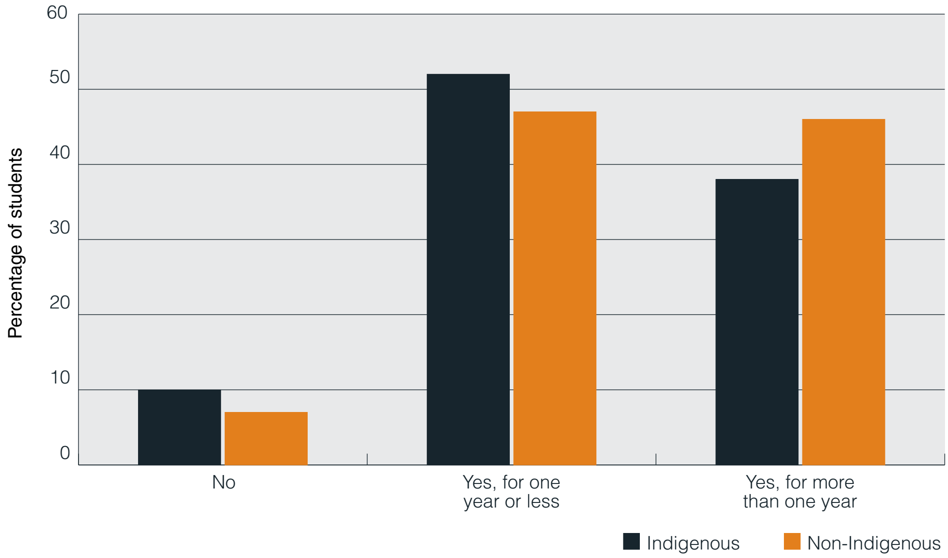

Figure 2.11 Pre-school attendance in PISA 2003 of Indigenous and non-Indigenous students

For Indigenous students, pre-school attendance matters, as there was a moderate positive association between attending pre-school and mathematical literacy performance ($r = 0.20$). Among non-Indigenous students, however, there was very little association between attending pre-school and mathematical literacy performance, with a correlation between these variables of 0.10.

As indicated by the strength of the correlations, the effect of pre-school attendance was substantially different for Indigenous and non-Indigenous students. Indigenous students who had attended pre-school for more than one year scored, on average, 69 points higher than Indigenous students who had not attended pre-school at all. Among non-Indigenous students there was, on average, 33 score points difference between those students who had attended pre-school for more than one year and those students who had not attended any pre-school (Figure 2.12).

7 Pre-school is known by a variety of names throughout Australia, but in this report refers to children attending an educational setting in the year prior to the beginning of formal education.

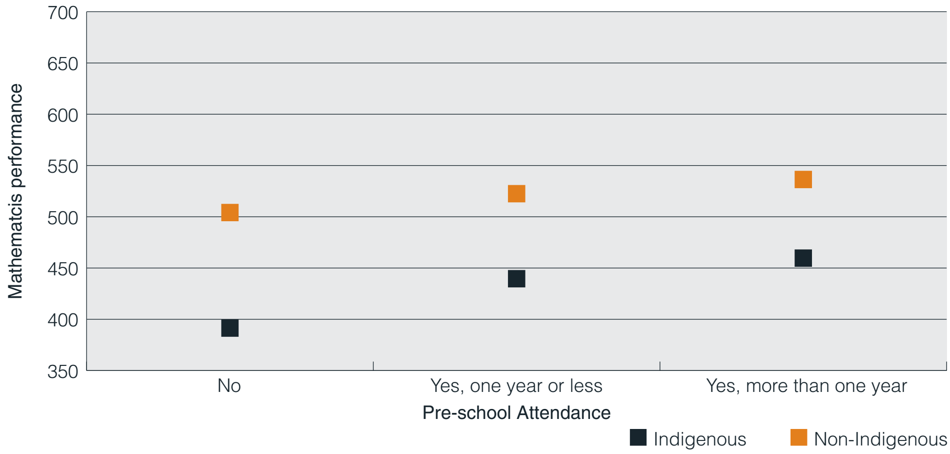

Figure 2.12 Mean mathematical literacy performance scores for each level of pre-school attendance, for Indigenous and non-Indigenous students

School attendance

In PISA 2000 and PISA 2003, data were collected about school attendance. In PISA 2000, students were asked how frequently, in the two weeks prior to participating in the PISA assessment, they had:

- arrived late for school,
- skipped classes, and
- missed a whole day of school.

Students were asked to indicate the frequency of these behaviours using one of four categories (none; one to two times; three or four times; and five or more times).

Overall, more Indigenous than non-Indigenous students indicated they had skipped classes in the two weeks prior to their assessment. Although the majority of students indicated that they had not skipped any classes, six per cent of Indigenous students and three per cent of non-Indigenous students had skipped classes at least three times during the two weeks prior to the PISA assessment.

Higher proportions of Indigenous than non-Indigenous students reported arriving late for school or missing a whole day of school. One in three Indigenous students, compared to one in four non-Indigenous students, reported arriving late for school once or twice, while almost one in five Indigenous students, compared to one in ten non-Indigenous students, arrived late for school at least three times during the two weeks before the PISA assessment (Table 2.6).

Almost half of the Indigenous students reported missing one or two entire days of school in the previous two weeks, compared to one-third of non-Indigenous students. Of greater concern are the 14 per cent of Indigenous students who reported having missed at least three whole days of school within a two week period, almost double the proportion of non-Indigenous students who had missed a similar number of days.

Table 2.6 School attendance in PISA 2000 for Indigenous and non-Indigenous students

School attendance (%)	PISA 2000							
	Indigenous students				Non-Indigenous students			
	None	1 or 2 times	3 or 4 times	5 or more times	None	1 or 2 times	3 or 4 times	5 or more times
Skipped classes	82	12	4	2	86	10	2	1
Arrived late for school	52	30	10	8	68	24	6	3
Missed a whole day of school	41	46	9	5	58	34	5	3

In PISA 2003, students once again were asked to indicate how frequently they had arrived late for school in the previous two full weeks. The proportion of Indigenous and non-Indigenous students who reported arriving late for school was similar to that reported in PISA 2000 (Table 2.7).

Table 2.7 Indigenous and non-Indigenous students arriving late for school in PISA 2003

School attendance (%)	PISA 2003							
	Indigenous students				Non-Indigenous students			
	None	1 or 2 times	3 or 4 times	5 or more times	None	1 or 2 times	3 or 4 times	5 or more times
Arrived late for school	52	28	11	9	64	26	6	4

Irregularities in school attendance were further explored in PISA 2000 by asking about the longest continuous period of time students had missed school in the previous three years. In PISA 2003, students were asked if they had missed two or more consecutive months in primary school or lower secondary school.

As shown in Figure 2.13, in PISA 2000 a higher proportion of Indigenous than non-Indigenous students had missed long periods of school. Although similar proportions of Indigenous and non-Indigenous students reported missing one or two weeks of school, there were more Indigenous than non-Indigenous students who indicated they had missed more than three weeks of schooling.

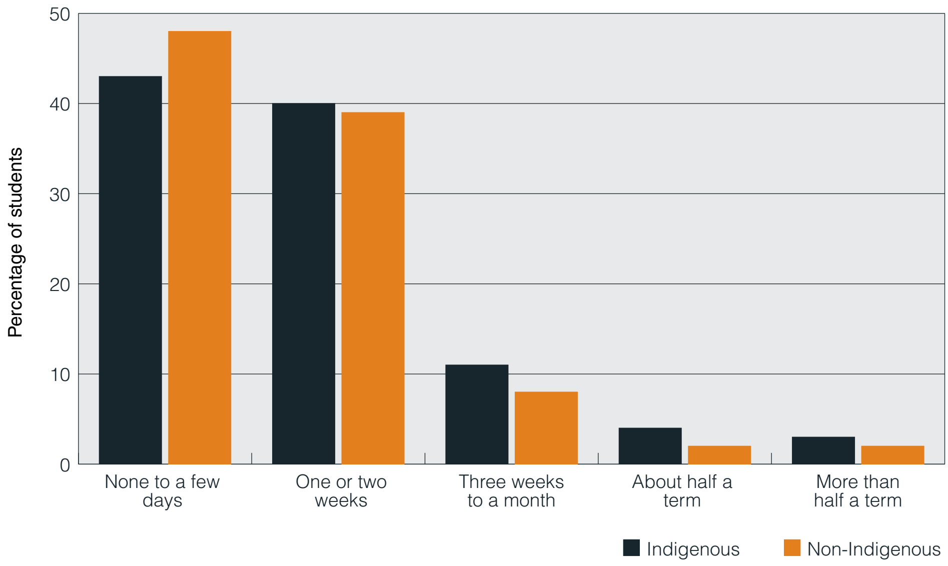

Figure 2.13 Indigenous and non-Indigenous students' reports of missing continuous periods of school, PISA 2000

In both primary and lower secondary school (up to Year 10), a greater proportion of Indigenous students reported missing at least two consecutive months of schooling than their non-Indigenous peers (PISA 2003 data).

Among both groups of students, the majority reported that they had never missed two consecutive months of either primary or lower secondary school (Figure 2.14). However, almost 20 per cent of Indigenous students had missed this amount of time at least once during primary school and 15 per cent during secondary school, compared to 12 per cent and eight per cent, respectively, for non-Indigenous students. Of greater concern is that five per cent of Indigenous students reported missing two or more consecutive months of primary school and seven per cent of Indigenous students reported missing the same amount of time in secondary school on two or more separate occasions.

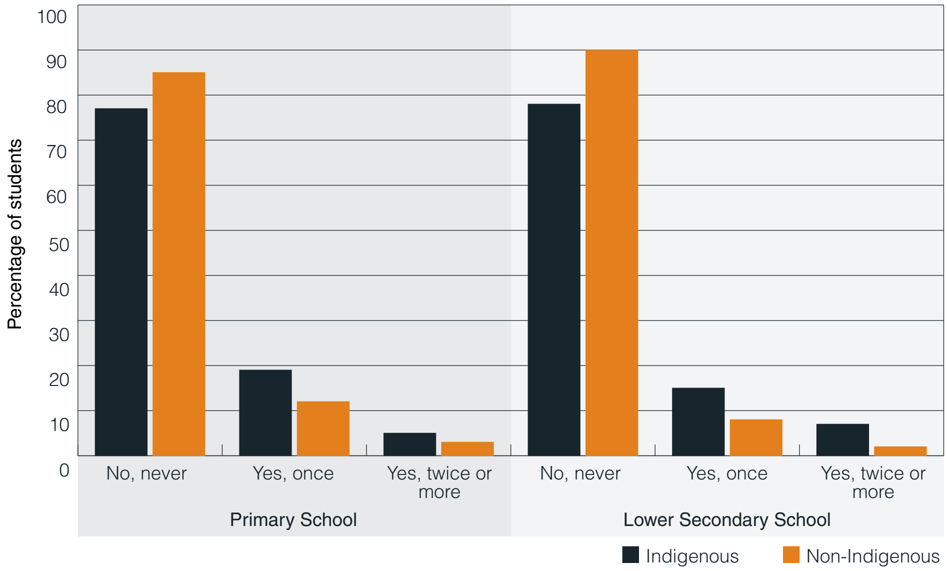

Figure 2.14 Indigenous and non-Indigenous students' reports of missing at least two months of consecutive schooling, PISA 2003

As would be expected, the greater the irregularity of school attendance, the lower a student's average performance on the various assessments. There was a weak negative association between the level of school non-attendance and student performance. The correlation between missing a whole day of school and reading literacy performance was -0.11 for both Indigenous and non-Indigenous students, indicating that increases in missing whole days of school (that is, missing more days) was associated with lower scores on the reading literacy assessment. The correlations between skipping classes and arriving late for school, and reading literacy performance for Indigenous students were -0.11 and -0.16, respectively, and for non-Indigenous students, -0.08 and -0.09, respectively.

For Indigenous students, a moderate negative correlation ($r = -0.16$) was found between missing continuous periods of primary school and mathematical literacy performance. The correlation was similar among non-Indigenous students ($r = -0.14$). There was also a moderate negative association between missing periods of school during the lower secondary level and mathematical literacy performance for Indigenous students ($r = -0.20$) and for non-Indigenous students ($r = -0.16$).

Summary

This chapter has provided a description of home and educational background factors that are measured in PISA and has illustrated the socioeconomic disadvantage faced by Indigenous students. More Indigenous students than their non-Indigenous peers come from socioeconomically disadvantaged backgrounds and this is strongly related to their poorer performance in PISA.

The chapter also described some of the constructs related to students' own educational background assessed in PISA. Indigenous students are less likely to have attended pre-school for more than one year, and to have poor school attendance records. These are factors clearly related to poorer school performance.

The next chapter explores the relationships between attitudes, engagement, motivation and beliefs and student achievement.

Chapter

3

Attitudes, engagement, motivation and beliefs

Key findings

- Compared to non-Indigenous students, Indigenous students reported significantly lower levels of:
  - interest in reading
  - interest in science
  - engagement in reading
  - engagement in science
  - appreciation of science from both a general and personal perspective
  - instrumental motivation in science
  - self-efficacy from a general view point
  - self-efficacy in mathematics
  - self-efficacy in science
  - mathematics self-concept
  - science self-concept.
- Compared to non-Indigenous students, Indigenous students reported significantly higher levels of mathematics anxiety.
- Indigenous females showed significantly more interest in reading and were more engaged in reading compared to Indigenous males.
- Indigenous males showed significantly higher levels of self-efficacy in mathematics, mathematics self-concept and science self-concept compared to Indigenous females.

Education aims to enable students to acquire not only knowledge but also the skills to become confident and enthusiastic learners. Beliefs, attitudes, engagement and motivation are all important factors that can enhance the learning process as students play a more proactive role, for example, by drawing on strong motivation.

Are students interested and do they enjoy learning? Do students believe they can succeed? Do students want to learn? These are some of the questions answered in this chapter as Indigenous students' views about their interest and enjoyment in reading, mathematics and science, their own competence, and motivations for learning, as well as the relationship between these factors and student performance, are explored.

Attitudes and Engagement

Attitudes have been shown in many studies to be an important factor in relation to performance levels. In each PISA cycle, students' attitudes to the subject area that was the major focus were examined.

Having an interest in and enjoying a subject affects not only the intensity, quality and persistence in specific learning situations but can also affect engagement in learning situations in general and enhances motivation. Engagement improves the process of learning because students who are engaged are more likely to learn and to develop a deeper understanding of the subject matter.

Interest in reading

PISA 2000 measured students' interest in reading using the following items:

- 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.

Students were asked to indicate their agreement on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Differences in responses to these items suggest that non-Indigenous students show more interest in reading than Indigenous students. More than 50 per cent of the non-Indigenous students agreed or strongly agreed that reading was too much fun to give up, compared to 44 per cent of Indigenous students who felt this way. Two-thirds of non-Indigenous students indicated that they became totally absorbed in their reading, compared to just over half of the Indigenous students. Similar proportions of Indigenous and non-Indigenous students (slightly less than half) indicated that they read in their spare time (Table 3.1).

Indigenous females agreed more readily with these items about interest in reading than did Indigenous males. More than half of the Indigenous females surveyed agreed that they wouldn't want to give up reading because it is fun, and also that they read in their spare time compared to one-third of Indigenous males. A significantly greater proportion of Indigenous females (65%) than Indigenous males (44%) reported they sometimes get totally absorbed in their reading.

Table 3.1 Indigenous and non-Indigenous students' interest in reading[8]

Interest in reading	Percentage of students who apply themselves often or almost always			
	non-Indigenous	Indigenous		
		All	Females	Males
Because reading is fun, I wouldn't want to give it up	**52**	**44**	**56**	**32**
I read in my spare time	49	44	**54**	**33**
When I read, I sometimes get totally absorbed	**65**	**55**	**65**	44

The three items listed above were used to create an index in the interest of reading. The score on the index indicates that non-Indigenous students scored at around the OECD average, meaning that their interest in reading was similar to the average across all OECD countries. Indigenous students were, however, significantly less interested in reading than either non-Indigenous students or indeed the OECD average. The mean scores for Indigenous and non-Indigenous students on the interest in reading index were -0.18 and -0.02, respectively.

A comparison of the index of interest in reading scores by gender shows that Indigenous males were less interested in reading than Indigenous females. These differences were statistically

8 Throughout this chapter, values in bold indicate statistically significant differences between either non-Indigenous and Indigenous students or Indigenous females and males.

significant. While Indigenous females showed an interest in reading (mean = 0.04) that was similar to the OECD average, and to the average for non-Indigenous students, the average for boys was -0.40, significantly lower than the OECD average. For non-Indigenous students there were also large gender differences: males recorded a mean score of -0.16, significantly below the OECD average, while females had a mean significantly above the OECD average at 0.13. Figure 3.1 presents the means on the interest in reading index graphically.

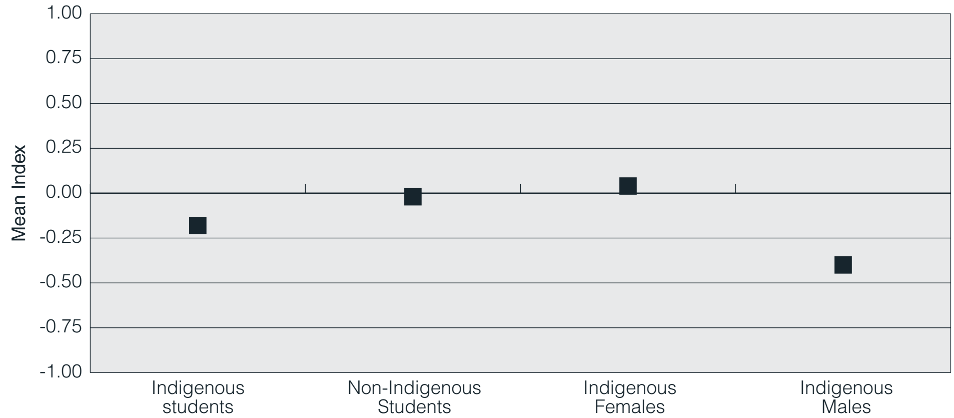

Figure 3.1 Interest in reading for Indigenous and non-Indigenous students, and Indigenous females and males

When the relationships between the interest in reading index and actual reading literacy was examined, it was found that the relationship was significantly stronger among non-Indigenous students, with a correlation of 0.36, while among Indigenous students the correlation was moderate at 0.19.

To provide further insight about the interest in reading index and reading literacy performance, the scores on the interest in reading index were divided into quarters and the average reading literacy performance was calculated for students in each of the quarters. Figure 3.2 illustrates the slightly curvilinear relationship between interest in reading and reading literacy, showing that those students with a very strong interest in reading, regardless of Indigenous status, had higher reading scores than students with less of an interest in reading. Of course, the direction of the influence is not determined by these simple relationships. There was, on average, approximately 60 score points' difference between Indigenous students in the highest and lowest quartiles on the interest in reading index, and approximately 100 score points on average for non-Indigenous students between the highest and lowest quartiles.

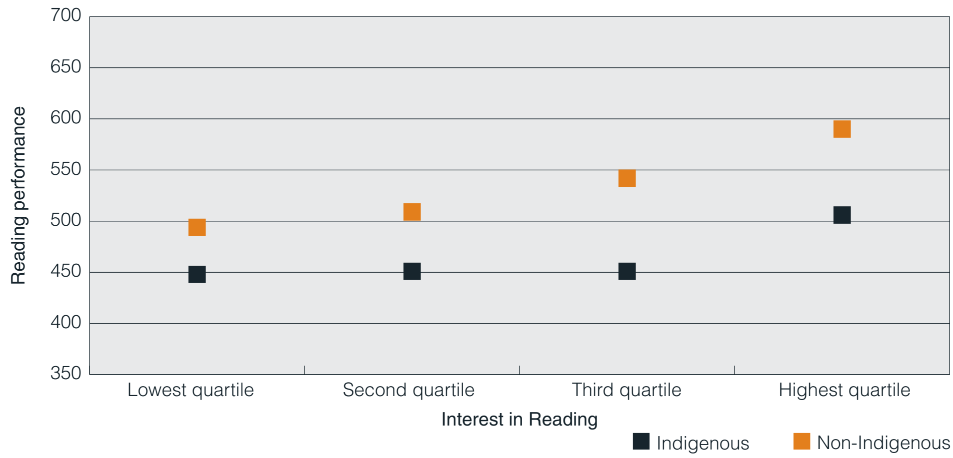

Figure 3.2 Mean reading literacy performance scores by quartiles on interest in reading Index, Indigenous and non-Indigenous students

Engagement in reading

Engagement in reading, or the extent to which reading is seen as a worthwhile and enjoyable activity, is likely to be of great importance to continued participation in this activity, and the increased exposure to information and knowledge that can result. Engagement in reading was measured in PISA 2000 by asking students the following items:

- I read only if I have to,
- Reading is one of my favourite hobbies,
- I like talking about books with other people,
- I find it hard to finish books,
- I feel happy if I receive a book as a present,
- For me, reading is a waste of time,
- I enjoy going to a bookshop or a library,
- I read only to get information that I need, and
- I cannot sit still and read for more than a few minutes.

Students were asked to indicate their level of agreement on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Table 3.2 shows the percentage of non-Indigenous and Indigenous students, as well as Indigenous females and males, who agreed or strongly agreed to items relating to engagement in reading. Overall, this paints a rather disappointing picture of students' engagement with reading. Around half of the Indigenous students surveyed said that they only read if they have to, almost 60 per cent say they only read to get the information they need, and almost 30 per cent say they cannot sit still and read for more than a few minutes. In each of these the proportion of Indigenous students holding the negative viewpoint was significantly higher than the corresponding proportion of non-Indigenous students.

Table 3.2 Indigenous and non-Indigenous students' engagement in reading

Engagement in reading	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I read only if I have to	**39**	**50**	**41**	**59**
Reading is one of my favourite hobbies	31	28	**39**	**16**
I like talking about books with other people	30	27	**33**	**22**
I find it hard to finish books	33	37	**26**	**48**
I feel happy if I receive a book as a present	45	45	**57**	**31**
For me, reading is a waste of time	24	27	**19**	**35**
I enjoy going to a bookshop or a library	43	41	**53**	**29**
I read only to get information that I need	**45**	**59**	**49**	**71**
I cannot sit still and read for more than a few minutes	**21**	**28**	24	33

Female Indigenous students showed signs of more positive attitudes towards reading than male Indigenous students. Many of these gender differences are quite marked. Almost 60 per cent of Indigenous males, compared to just over 40 per cent of Indigenous females, agreed that they read only if they have to. More than one-third of Indigenous males and around one-fifth of Indigenous females believed that reading was a waste of time. Seventy-one per cent of Indigenous males and almost half of the Indigenous females surveyed only read to get the information they need. In contrast, almost 40 per cent of Indigenous females and only 16 per cent of indigenous males agreed that reading was a favourite hobby.

The nine items listed above were used to construct an index for student's engagement in reading (Table 3.2). A high positive value on this index indicates a high engagement with reading, i.e. students report more frequently that reading is one of their favourite hobbies, that they like talking about books with other people, that they feel happy if they receive a book as a present, and that they enjoy going to a bookshop or a library. A positive value also indicates that students report less frequently that they read only if they have to, that they find it hard to finish books, that reading is a waste of time, that they read only to get information that they need, and that they cannot sit still and read for more than a few minutes. As would be expected from the data shown in Table 3.2, Indigenous students were significantly less engaged in reading than non-Indigenous students with mean scores of -0.22 and -0.07, respectively, on the reading engagement index.

The mean scores on the engagement in reading index for non-Indigenous and Indigenous students, and Indigenous females and males are shown in Figure 3.3. The mean score for Indigenous females on the engagement in reading index was 0.02, while the mean score for Indigenous males was a very low -0.48. These results indicate that Indigenous males were far less engaged with reading on average than any other group of students, including non-Indigenous males (who had a mean of –0.28, while non-Indigenous females had a mean of 0.17).

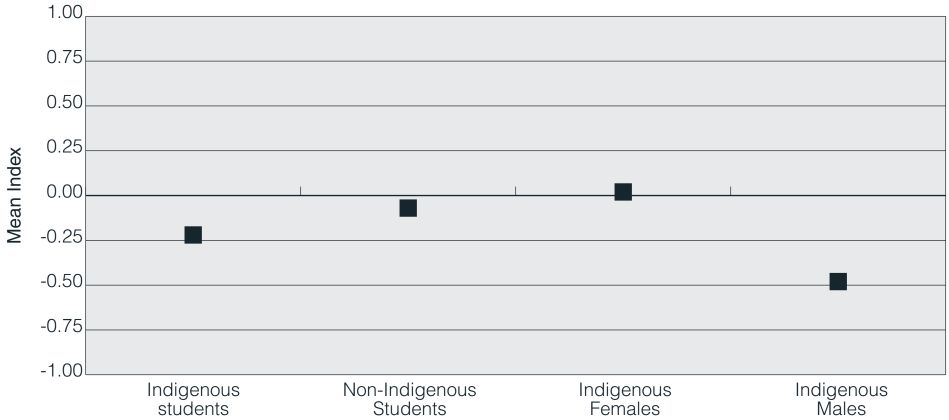

Figure 3.3 Engagement in reading for Indigenous and non-Indigenous students, and Indigenous females and males

The relationship between the engagement in reading index and reading literacy performance was strong and positive, and was one of the highest correlations found between any of the PISA indices and student performance. For Indigenous students, the correlation was 0.31, while for non-Indigenous students the correlation was 0.43. The relationship between engagement in reading and reading literacy is shown graphically in Figure 3.4 for Indigenous and non-Indigenous students, and again shows the strong relationship between engagement and achievement in reading. There was a 78 score point difference on average between the reading literacy scores of Indigenous students in the lowest and highest quartiles on the engagement in reading index. Among non-Indigenous students, those in the highest engagement in reading quartile scored 114 points higher on average in reading literacy than those in the lowest quartile of reading engagement.

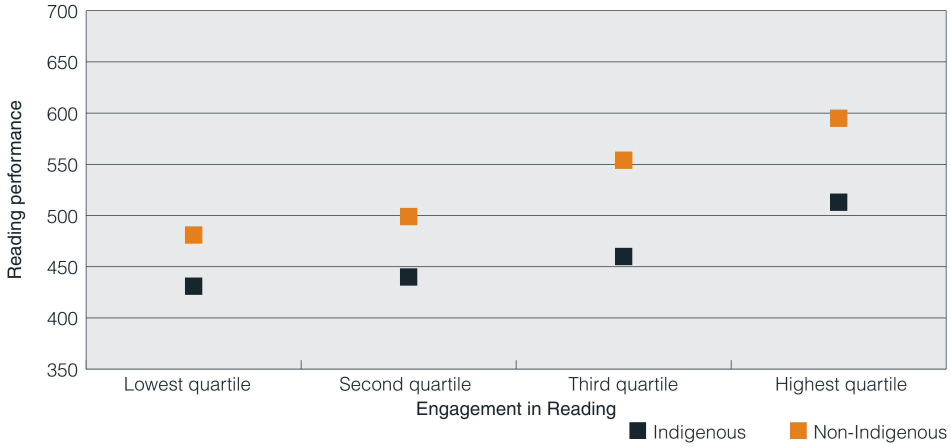

Figure 3.4 Mean reading literacy performance scores by quartiles on enjoyment in reading Index, Indigenous and non-Indigenous students

Reading diversity

Given there are significant differences in the engagement in reading index by gender, it is of interest to explore the different materials students choose to read. Research has shown that there are certain types of books that are typically more or less appealing to members of one sex than to the other (Schultehis, 1990; Benton, 1995).

Students were given a list of six different reading materials (magazines; comic books; fiction (novels, narratives, stories); non-fiction books; emails/web pages and newspapers) and were asked how frequently (on a five point scale: never or hardly ever, a few times a year, about once a month, several times a month and several times a week) they read these materials because they want to.

Table 3.3 shows the percentage of non-Indigenous and Indigenous students who reported reading each of the various types of reading materials several times a week by choice (Indigenous males and females are also reported separately). Magazines, newspapers, emails and web pages were the most common reading materials for all groups of students. The proportion of Indigenous students who reported reading magazines, comics and newspapers several times a week was significantly higher than the corresponding proportion of non-Indigenous students, while significantly more non-Indigenous students than Indigenous students read emails and web pages several times a week[9].

Preferences for reading materials amongst Indigenous students were quite gender specific: males were more likely to report reading comics or magazines while more females reported reading fiction books. Interestingly, one-fifth of Indigenous females and one half of the Indigenous males reported that they never or hardly ever read fiction books, while only one in twenty Indigenous students never or hardly ever read a newspaper.

9 However as reported in Chapter 2, the percentage of Indigenous students with internet access is lower than that of non-Indigenous students.

Table 3.3 Materials read by non-Indigenous and Indigenous students

Reading materials	Percentage of students who read several times a week			
	non-Indigenous	Indigenous		
		All	Females	Males
Magazines	**28**	**35**	30	40
Comic books	**4**	**9**	**4**	**14**
Fiction (novels, narratives, stories)	14	12	**17**	**6**
Non-fiction books	5	7	7	7
Emails and Web pages	**37**	**23**	22	24
Newspapers	**35**	**45**	46	43

An index of reading diversity was created using the six different reading materials items. A higher mean score on the index indicates the reading of a greater diversity of materials compared to a lower mean score on the index. The mean scores were -0.05 for Indigenous students and 0.06 for non-Indigenous students, indicating that, overall, there was no significant difference in the variety of reading materials accessed by Indigenous and non-Indigenous students.

There were no significant gender differences between Indigenous students in terms of reading material diversity, with mean scores of 0.01 for Indigenous females and -0.12 for Indigenous males on the index.

Interest in and enjoyment in mathematics

In PISA 2003, data was collected about students' interest in and enjoyment in mathematics by students responses to four items:

- I enjoy reading about mathematics,
- I look forward to my mathematics lessons,
- I do mathematics because I enjoy it, and
- I am interested in the things I learn in mathematics.

Students were asked to indicate their agreement on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

The responses to these items suggest that while Australian 15-year-old students may be interested in what they are learning in mathematics classes, with half of the students agreeing or strongly agreeing with this item, enjoyment of mathematics is less common. Around one-third of students agreed or strongly agreed that they enjoy reading about mathematics, look forward to their mathematics lessons, or do mathematics because they enjoy it. This pattern of greater endorsement of the interest items and lower endorsement of the enjoyment items was found to be common across Indigenous and non-Indigenous students, as well as male and female Indigenous students.

As shown in Table 3.4, similar percentages of Indigenous females and males agreed or strongly agreed with items relating to their interest and enjoyment in mathematics. No significant differences were found between the responses of Indigenous females and males.

Table 3.4 Indigenous and non-Indigenous students' reports on interest in and enjoyment in mathematics

Items about interest in and enjoyment in mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I enjoy reading about mathematics	28	30	26	34
I look forward to my mathematics lessons	37	42	38	46
I do mathematics because I enjoy it	36	40	37	42
I am interested in the things I learn in mathematics	51	52	52	53

An index of interest and enjoyment in mathematics was constructed using the above items. A high value on the index signifies greater student interest and enjoyment in mathematics. The mean for Indigenous students was 0.04 and not significantly different from the mean for non-Indigenous students at 0.01. These mean scores were also similar to the OECD average. Indigenous females and males reported similar levels of interest and enjoyment in mathematics with means of -0.01 and 0.09, respectively. In contrast, among non-Indigenous students, males had significantly higher levels of interest and enjoyment in mathematics than did females, with mean scores of 0.12 and –0.10, respectively.

The association between interest and enjoyment of mathematics and mathematical literacy differed significantly between Indigenous students and non-Indigenous students. For Indigenous students, the association between interest and enjoyment in mathematics and mathematical literacy performance was very weak ($r = 0.06$). Among non-Indigenous students, however, there was a relatively moderate positive association between interest and enjoyment in mathematics and mathematics performance ($r = 0.19$).

For Indigenous students, there was little relationship between level of interest and enjoyment and mathematics performance, with, on average, a 14 score point difference between Indigenous students in the highest and lowest quartiles on the enjoyment in mathematics index (Figure 3.5). For non-Indigenous students there was a positive relationship, with almost 50 points difference between the average score for non-Indigenous students in the highest and lowest quartiles of interest and enjoyment in mathematics.

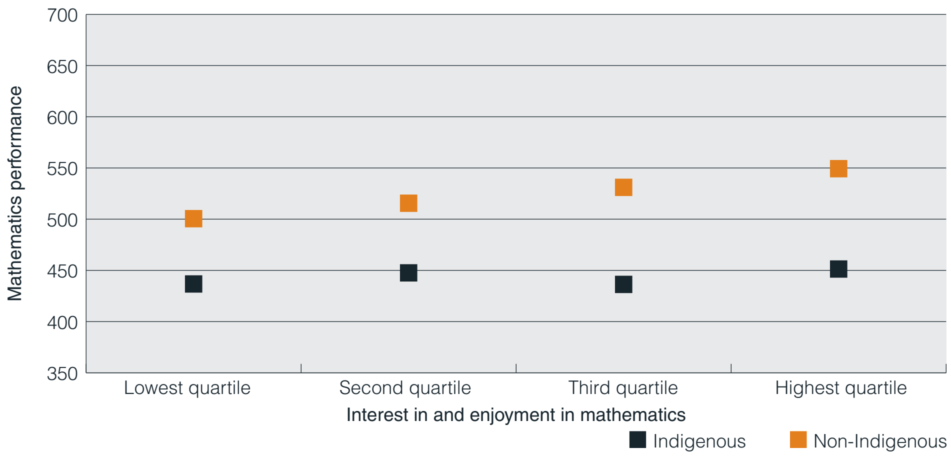

Figure 3.5 Mean mathematics literacy performance scores by quartiles on the interest in and enjoyment in mathematics index, for Indigenous and non-Indigenous students

General interest in learning science

In PISA 2006, questions related to students' interest in science were posed in a slightly different way to questions in previous cycles of PISA about interest in reading and mathematics. Students were asked how much interest they have in learning the following science topics:

- Physics,
- Chemistry,
- Biology of plants,
- Human Biology,
- Astronomy,
- Geology,
- Ways scientists design experiments, and
- What is required for scientific explanations.

Students were asked to indicate their level of interest for each on a four point scale (high interest; medium interest; low interest; and no interest).

Table 3.5 shows the percentage of Indigenous and non-Indigenous students, as well as Indigenous females and males, who indicated a high or medium interest in learning these science topics. Significantly fewer Indigenous students reported having interest in physics, chemistry, the biology of plants, human biology and astronomy than non-Indigenous students. The gender differences found in the general student population were also found in the Indigenous sample: a higher proportion of females than males were interested in biology, while a greater proportion of males than females were interested in learning about physics.

Table 3.5 Indigenous and non-Indigenous students' reports on their interest and enjoyment in science

Items about general interest in learning science	Percentage of students who have a high or medium interest			
	non-Indigenous	Indigenous		
		All	Females	Males
Topics in physics	**45**	**38**	**32**	**45**
Topics in chemistry	**48**	**37**	36	37
The biology of plants	**40**	**36**	**41**	**30**
Human Biology	**63**	**53**	**60**	**47**
Topics in astronomy	**47**	**39**	39	39
Topics in geology	32	28	26	29
Ways scientists design experiments	36	36	35	37
What is required for scientific explanations	29	27	25	29

An index of general interest in learning science was created using the eight science topics items. A higher mean score on this index indicates a greater interest in learning science than a lower mean score.

On average, Indigenous students were significantly less interested than non-Indigenous students in learning science. The mean scores for Indigenous and non-Indigenous students on the general interest in learning science index were -0.43 and -0.21, respectively, both of which were substantially lower than the OECD average. There were no significant gender differences among Indigenous students with mean scores of -0.44 for Indigenous females and -0.43 for Indigenous males (Figure 3.6).

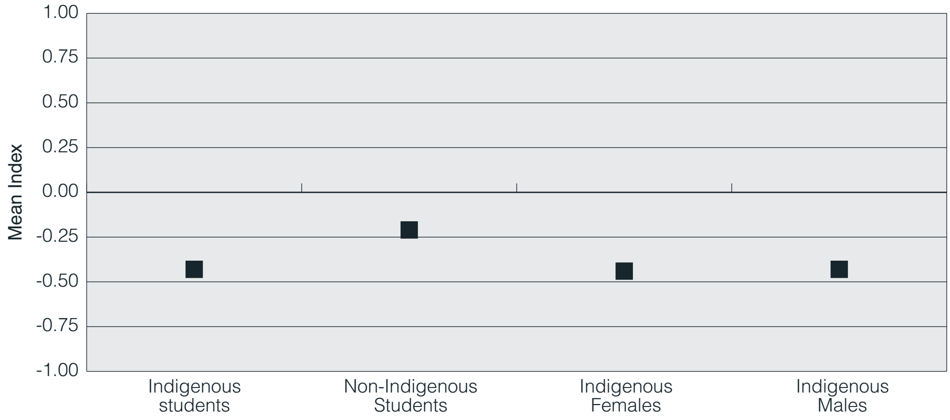

Figure 3.6 General interest in learning science for Indigenous and non-Indigenous students, and Indigenous females and males

There was a positive association between general interest in learning science and scientific literacy performance, indicating that as general interest in science topics increased so too did scores in scientific literacy, with moderate correlations of 0.22 for Indigenous students and 0.30 for non-Indigenous students.

Enjoyment of science

PISA 2006 measured students' enjoyment of science. Students were asked to indicate their agreement on a four-point scale (strongly agree; agree; disagree; and strongly disagree) to the following items:

- I generally have fun when I am learning science topics,
- I like reading about science,
- I am happy doing science problems,
- I enjoy acquiring new knowledge in science, and
- I am interested in learning about science.

Significant differences were found between Indigenous and non-Indigenous students' reports of enjoying science. Table 3.6 shows there were higher proportions of Indigenous than non-Indigenous students who were happy doing science problems, enjoyed acquiring new knowledge in science, and were interested in learning about science. On the other hand, more non-Indigenous students agreed or strongly agreed that they generally have fun when they are learning science topics and that they like reading about science.

On average, Indigenous males and females showed no significant differences in their levels of enjoyment of science.

Table 3.6 Indigenous and non-Indigenous students' reports on level of enjoyment of science

Items about enjoyment in science	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I generally have fun when I am learning science topics	**59**	**49**	46	52
I like reading about science	**44**	**35**	34	36
I am happy doing science problems	**50**	**59**	40	41
I enjoy acquiring new knowledge in science	**33**	**42**	57	59
I am interested in learning about science	**38**	**48**	53	52

The index of enjoyment in science is derived from students' responses to the above five items. The higher the mean on the enjoyment of science index, the more enjoyment students report in learning science. On average, non-Indigenous students reported higher enjoyment of science than Indigenous students, although neither was positive. The mean index for non-Indigenous students was -0.07, and although below the OECD average, was significantly higher than that of Indigenous students (-0.29).

Significant gender differences in enjoyment of science were found only among non-Indigenous students. Non-Indigenous males scored higher, on average, on the enjoyment of science index than non-Indigenous females, with mean scores of -0.02 and -0.12, respectively. Among Indigenous students, there were no significant differences between the average enjoyment of science index scores of females (-0.32) and males (-0.26) (Figure 3.7).

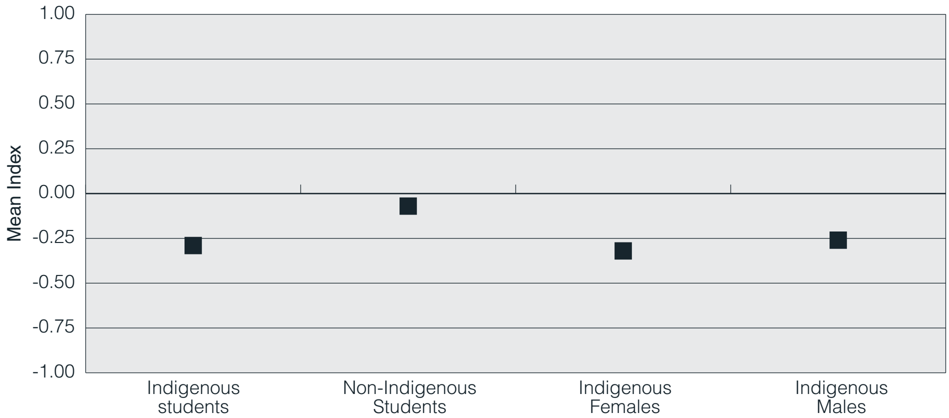

Figure 3.7 Enjoyment in science for Indigenous and non-Indigenous students, and Indigenous females and males

Enjoyment of science had a strong positive relationship with scientific literacy performance among both groups of students. This is unfortunate given the low levels of enjoyment of science exhibited by both Indigenous and non-Indigenous students. For Indigenous students, the correlation between enjoyment of science and scientific literacy was 0.31, while for non-Indigenous students the relationship was stronger, with a correlation of 0.44.

Figure 3.8 shows the relationship for Indigenous and non-Indigenous students between enjoyment of science and science performance, with average scientific literacy scores increasing in line with enjoyment of science index scores (divided into quarters). Indigenous students in the highest quarter of the enjoyment of science index scored, on average, 85 points higher than the Indigenous students in the lowest quarter of this index. For non-Indigenous students, there was, on average, 110 points difference between students in the highest quarter on the enjoyment of science index and those in the lowest quarter of the index.

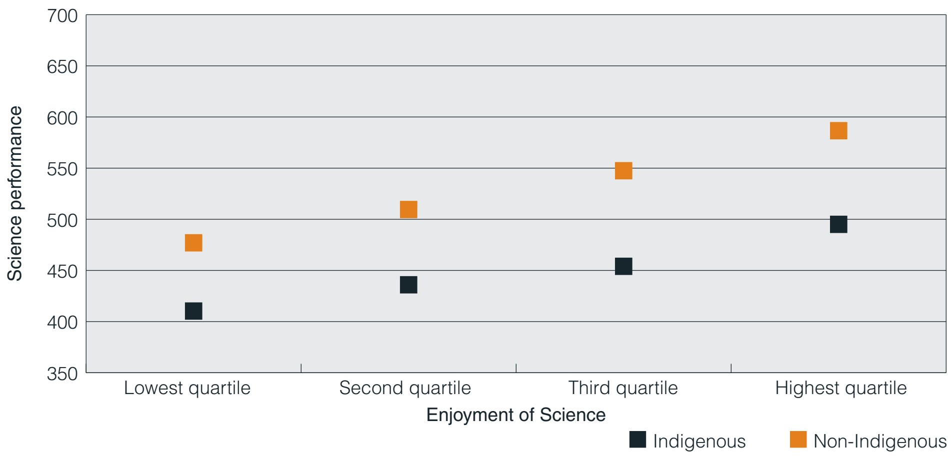

Figure 3.8 Mean scientific literacy performance scores by quartiles on the enjoyment of science index, for Indigenous and non-Indigenous students

General value of science

In 2006, information was collected about the extent that students' value the contribution of science and technology to society by asking them to respond to the following items:

- Advances in science and technology usually improve people's living conditions,
- Science is important for helping us to understand the natural world,
- Advances in science and technology usually help improve the economy,
- Science is valuable to society, and
- Advances in science and technology usually bring social benefits.

Students indicated how strongly they agreed (on a four-point scale: strongly agree; agree; disagree; and strongly disagree) with these items.

The majority of Australian students reported that they valued the contribution of science and technology. Indigenous and non-Indigenous students both agreed more readily that scientific and technological advances bring about improvements to the economy and a greater understanding of the natural world than to the general social condition.

While the general pattern of agreement across the items is similar, as Table 3.7 shows, agreement with these items appears to be stronger among non-Indigenous students than among Indigenous students. Over 94 per cent of non-Indigenous and 90 per cent of Indigenous students believed that science was important for understanding the natural world. Ninety per cent of non-Indigenous and 80 per cent of Indigenous students indicated their agreement that advances in science and technology usually improve people's living conditions, and that science was valuable to society.

There were no significant differences between Indigenous females and males in terms of their agreement with the general value of science items.

Table 3.7 Indigenous and non-Indigenous students' views of the general value of science

Items about general value of science	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
Advances in science and technology usually improve people's living conditions	91	81	80	83
Science is important for helping us to understand the natural world	94	90	91	89
Advances in science and technology usually help improve the economy	85	78	77	78
Science is valuable to society	90	80	82	78
Advances in science and technology usually bring social benefits	69	63	64	61

The general value of science index was created using the five items above, and scaled as previously described with the OECD average set to zero. A higher positive value on the index represents a stronger valuing of the contribution of science and technology to society. Overall, a comparison of the mean index scores of Indigenous and non-Indigenous students indicates that valuing the contributions of science and technology is stronger among non-Indigenous students (with a mean score of -0.04) than among Indigenous students (with a mean score of -0.41).

There were no significant differences in the mean scores reported for Indigenous females and males (-0.40 and -0.43, respectively). Both were significantly lower than the OECD average, and significantly lower than the average for non-Indigenous students (Figure 3.9).

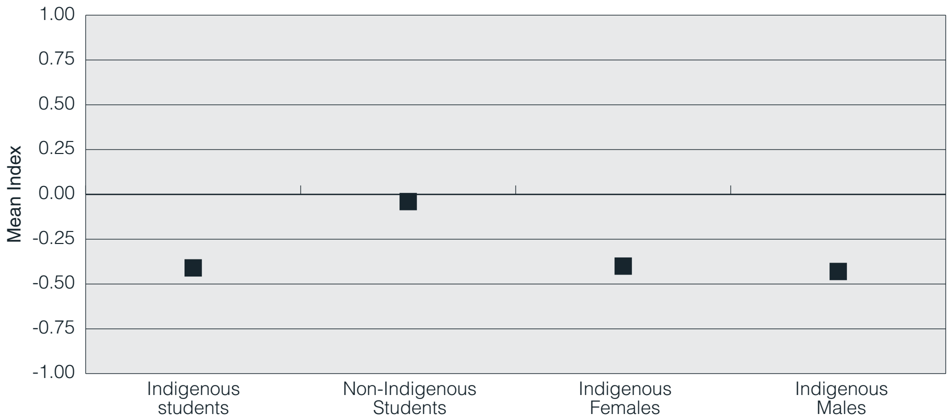

Figure 3.9 General value of science for Indigenous and non-Indigenous students, and Indigenous females and males

General value of science was found to have a strong positive relationship with scientific literacy. The correlation between general value of science and scientific literacy for Indigenous students was 0.40, while among non-Indigenous students the correlation was 0.37.

Personal value of science

A second measure of valuing science was investigated in PISA 2006, with the focus shifting from general support of science to students' personal value of science. Students were asked about their perceptions of the personal importance of science using the following items:

- Some concepts in science help me see how I relate to other people,
- I will use science in many ways when I am an adult,
- Science is very relevant to me,
- I find that science helps me to understand the things around me, and
- When I leave school there will be many opportunities for me to use science.

Students indicated how strongly (on a four-point scale: strongly agree; agree; disagree; and strongly disagree) they agreed with these items.

While the majority of students indicated they valued science in general, there were fewer students who indicated they valued science from a personal perspective. A similar percentage of Indigenous and non-Indigenous students reported that some concepts in science help them relate to other people. A significantly higher proportion of non-Indigenous students than Indigenous students agreed that science helps them to understand the world around them, that when they leave school there will be opportunities for them to use science, and that they will use science when they are adults. Although more than half the non-Indigenous students agreed or strongly agreed that science was relevant to them, fewer than half the Indigenous students could see such relevance.

Among Indigenous students, there were no differences between female and male students' appreciation of science on a personal level, except on the item pertaining to science helping them relate to other people; 66 per cent of females compared to 57 per cent of males agreed with this item (Table 3.8).

Table 3.8 Indigenous and non-Indigenous students' reports on personal value of science

Items about personal value of science	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
Some concepts in science help me see how I relate to other people	62	62	**66**	**57**
I will use science in many ways when I am an adult	**64**	**57**	56	57
Science is very relevant to me	**56**	**44**	46	41
I find that science helps me to understand the things around me	**74**	**70**	69	70
When I leave school there will be many opportunities for me to use science	**61**	**52**	50	54

An index of personal value of science was constructed using the above items. A high value on the index signifies greater valuing of science at a personal level. Indigenous students, on average, recorded significantly lower scores on the personal value of science index compared to their non-Indigenous peers. The mean for Indigenous students was significantly lower than the OECD average at -0.22, while the mean for non-Indigenous students was at the OECD average at 0.02.

There were no significant differences between Indigenous females and males with means of -0.17 and -0.27 respectively on the personal value of science index; however, both were significantly lower than the OECD average (Figure 3.10).

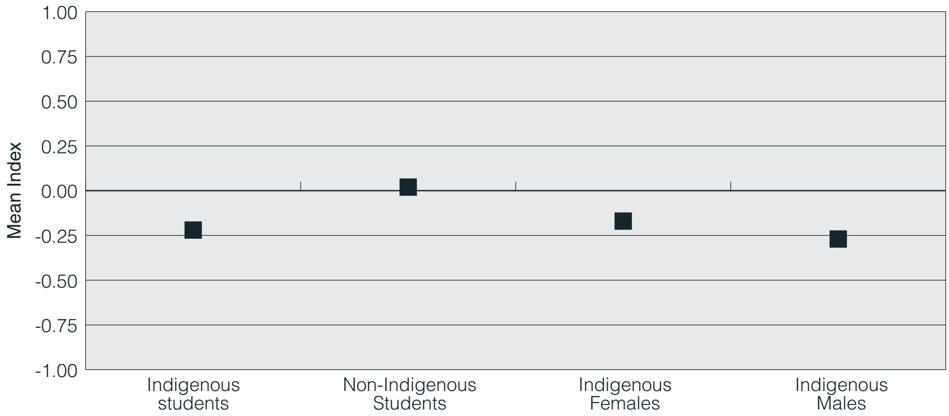

Figure 3.10 Personal value of science for Indigenous and non-Indigenous students, and Indigenous females and males

For Indigenous students, the association between personal value of science and scientific literacy was moderately positive, with a significant correlation of 0.21. For non-Indigenous students, there was a strong positive association between personal value of science and scientific performance, with a correlation of 0.36.

Motivation

Motivation, like engagement, is an important factor that may contribute to success at school and to lifelong learning. Students who recognise the importance of setting their own learning goals and who reach those goals will optimise opportunities for learning throughout life. Motivation can influence whether an individual will pursue further educational paths or particular job opportunities.

Researchers typically distinguish between two main forms of motivation – intrinsic motivation (the extent to which a student pursues an interest, topic or activity because of a personal interest) and extrinsic motivation (the external rewards for doing something, such as approval, better grades or performance or a more prestigious career).

Instrumental motivation

Instrumental motivation can be defined as doing something in order to gain some external reward in the future, and as such is a particular form of extrinsic motivation. Three items were used in PISA 2000 to measure students' instrumental motivation:

- I study to increase my job opportunities,
- I study to ensure that my future will be financially secure, and
- I study to get a good job.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always).

The data presented in Table 3.9 indicates that the majority of Australian students endorsed these items, indicating that they often or almost always studied in order to increase their job opportunities, ensure the financial security of their future or to get a good job. There were no significant differences in the way Indigenous and non-Indigenous students, or Indigenous females and males, responded to these items.

Table 3.9 Indigenous and non-Indigenous students' reports on level of instrumental motivation

Items about instrumental motivation	Percentage of students who apply themselves often or almost always			
	non-Indigenous	Indigenous		
		All	Females	Males
I study to increase my job opportunities	58	57	58	57
I study to ensure that my future will be financially secure	54	56	51	61
I study to get a good job	63	66	66	65

The index of instrumental motivation was derived from these items. Reflecting the moderate endorsement of the instrumental motivation items by Australian students, their average scores on the index were below the OECD average, at -0.20 for Indigenous students and -0.21 for non-Indigenous students. No significant gender differences were found for Indigenous students, with mean scores of -0.20 for females and -0.21 for males.

The association between instrumental motivation and reading literacy performance was negligible, with a correlation of 0.05 among Indigenous students and 0.07 among non-Indigenous students.

Instrumental motivation in mathematics

In 2003, when the major assessment domain of PISA was mathematical literacy, students were asked to respond to the following items about instrumental motivation for learning mathematics:

- Making an effort in mathematics is worth it because it will help me in the work that I want to do later on,
- Learning mathematics is worthwhile for me because it will improve my career prospects,
- Mathematics is an important subject for me because I need it for what I want to study later on, and
- I will learn many things in mathematics that will help me get a job.

Students were asked to indicate the extent to which they agreed with these items, using a four-point scale (strongly agree; agree; disagree; and strongly disagree).

At least three-quarters of Australian students agreed or strongly agreed that learning mathematics and making an effort was important for future study and career prospects. The responses of Indigenous and non-Indigenous students were similar on all but one item about motivation for learning mathematics. Significantly more Indigenous than non-Indigenous students agreed or strongly agreed that they learn many things in mathematics that will help them to get a job, although the majority of both groups of students endorsed this item (Table 3.10).

Indigenous females and males equally reported that they recognise the importance of learning mathematics and making an effort in mathematics to help them in the future. Three-quarters of both Indigenous females and males agreed or strongly agreed that mathematics is an important subject because it will improve their career prospects, and approximately 85 per cent of Indigenous females and males said they make an effort and learn mathematics to help them get a job, help them in the work they want to do or to improve their career prospects. Thus, Indigenous females and males had very similar views as to the importance of mathematics to their future student and career goals.

Table 3.10 Indigenous and non-Indigenous students' level of instrumental motivation in mathematics

Items about instrumental motivation	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
Making an effort in mathematics is worth it because it will help me in the work that I want to do later on	83	83	83	83
Learning mathematics is worthwhile for me because it will improve my career prospects	87	84	83	85
mathematics is an important subject for me because I need it for what I want to study later on	74	74	74	74
I will learn many things in mathematics that will help me get a job	**79**	**83**	83	83

An index was constructed using these items to summarise instrumental motivation in mathematics. The means for Indigenous and non-Indigenous students on the instrumental motivation index were 0.20 and 0.23, respectively, and were not significantly different. These means, both above the OECD average, indicate Australian students recognise the importance of external future rewards in learning mathematics more so than students on average across the OECD.

There were no significant differences between the average scores of Indigenous males (0.22) and females (0.18).

There was a weak correlation between instrumental motivation in mathematics and mathematical literacy performance for Indigenous students ($r = 0.09$), while the correlation for non-Indigenous students was moderate ($r = 0.18$).

Instrumental motivation in science

Instrumental motivation in PISA 2006 focused on the external rewards that encourage students to learn, to choose subjects and to choose careers in relation to science. PISA collected information on instrumental motivation in science using the following five items:

- Making an effort in my science subject(s) is worth is because this will help me in the work I want to do later on,
- What I learn in my science subject(s) is important for me because I need this for what I want to study later on,
- I study science because I know it is useful for me,
- Studying in my science subject(s) is worthwhile for me because what I learn will improve my career prospects, and
- I will learn many things in my science subject(s) that will help me get a job.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Table 3.11 shows that non-Indigenous students generally had higher levels of instrumental motivation than Indigenous students. That is they were significantly more likely to agree that they study science because it is useful to them, that studying science is worthwhile because it improves career prospects, that they will learn many things in science that will help them to get a job, and that they learn science because it is needed in future studies.

Indigenous females and males had similar responses to the instrumental motivation in science items, with no significant differences found by gender.

Table 3.11 Indigenous and non-Indigenous students' level of instrumental motivation in science

Items about instrumental motivation in science	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
Making an effort in my science subject(s) is worth is because this will help me in the work I want to do later on	67	64	66	61
What I learn in my science subject(s) is important for me because I need this for what I want to study later on	**55**	**47**	45	48
I study science because I know it is useful for me	**70**	**57**	58	57
Studying in my science subject(s) is worthwhile for me because what I learn will improve my career prospects	**65**	**55**	57	54
I will learn many things in my science subject(s) that will help me get a job	**62**	**54**	56	52

These five items were used to construct an index of instrumental motivation in science. The average scores of Indigenous and non-Indigenous students on the instrumental motivation in science index were significantly different from one another, with Indigenous students scoring significantly lower, on average, (-0.13) than non-Indigenous students (0.11).

There were no significant gender differences found in the level of instrumental motivation in mathematics (Figure 3.11).

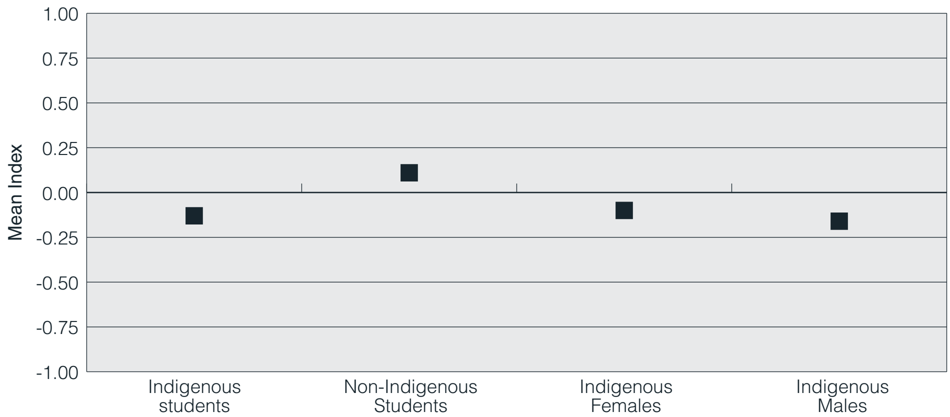

Figure 3.11 Instrumental motivation in science for Indigenous and non-Indigenous students, and Indigenous females and males

Instrumental motivation in science was found to have a moderately strong positive relationship with scientific literacy performance. Among Indigenous students, the correlation between instrumental motivation in science and scientific literacy was moderate ($r = 0.20$), while for non-Indigenous students the relationship was slightly stronger, with a correlation of 0.32.

Effort and persistence

Effort and persistence are subset constructs of motivation. A will to learn, must be present immediately before and at the time that learning takes place. The following items were presented to students to collect information about their levels of effort and persistence:

- When studying, I work as hard as possible,
- When studying, I keep working even if the material is difficult,
- When studying, I try to do my best to acquire the knowledge and skills taught, and
- When studying, I put in my best effort.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always) to the following items:

Overall, students reported behaving in a persistent or effortful way towards their study with relative frequency. Approximately 60 per cent of Australian students reported applying themselves often or almost always to work as hard as possible, or putting in their best effort. Indigenous students were less likely than non-Indigenous students to persist when the material was difficult: 44 per cent reported that in this case they frequently kept working compared to 54 per cent of non-Indigenous students. Non-Indigenous students (64%) also indicated more frequently than Indigenous students (57%) that they tried to do their best to acquire the knowledge and skills taught. Indigenous females and males were found to report using effort and persistence for learning in a similar manner (Table 3.12).

Table 3.12 Indigenous and non-Indigenous students' reports of levels of effort and persistence

Items about effort and persistence	Percentage of students who apply themselves often or almost always			
		Indigenous		
When I study:	**non-Indigenous**	**All**	**Females**	**Males**
I work as hard as possible	62	60	64	57
I keep working even if the material is difficult	**54**	**44**	41	48
I try to do my best to acquire the knowledge and skills taught	**64**	**57**	59	54
I put in my best effort	62	60	60	60

The effort and persistence index was constructed using students' responses to these four items. The mean score for Indigenous students on this index was below the OECD average, at -0.06, while the mean score for non-Indigenous students was not significantly different to the OECD average, at 0.02. There was no statistically significant difference between the average score of Indigenous females (0.00) and Indigenous males (-0.12) on the effort and persistence index. In comparison, non-Indigenous females reported putting more effort and persistence into studying (with a mean score of 0.06) than did non-Indigenous males (with a mean score -0.02).

There was a weak but positive association between effort and persistence and reading literacy performance, with a correlation of 0.10 for Indigenous students and 0.17 for non-Indigenous students.

Beliefs

Students form beliefs about their own capabilities, and these self-related beliefs have a considerable impact on goal setting, strategy use and achievement (Zimmermann, 1999). PISA assessed the self-related belief systems of self-efficacy and self-concept.

The influence of self-efficacy on performance has been well documented. Bandura (1982,1986) postulated that a person's self-efficacy concerning the ability to successfully perform a given task is a reliable predictor on whether the person will attempt the task, how much energy they will spend, and how much the person will persevere in pursuing the task. Consequently, students with higher self-efficacy are often those students who report greater effort, more motivation and therefore, improved achievement.

In contrast to self-efficacy, which asks students about their level of confidence in tackling specific tasks (scientific tasks in PISA 2006), self-concept measures the general level of belief that students have in their own academic abilities. Self-concept is an important outcome of education and a powerful predictor of student success (Strein, 1993).

Self-efficacy and self-concept may play important roles in learning because they provide the foundation for motivation and influence the level of effort and persistence a student applies to performing a task and reaching a particular outcome.

In 2000, PISA included items relating to students' general self-efficacy, while self-concept was also addressed from a general perspective and specifically in relation to reading. In PISA 2003, self-efficacy and self-concept were measured specifically in relation to mathematics, and in PISA 2006, these constructs were measured in relation to science.

General self-efficacy

In PISA 2000, the following three items were used to collect information about a student's general sense of self-efficacy:

- I'm certain I can understand the most difficult material presented in texts,
- I'm confident I can do an excellent job on assignments and tests, and
- I'm certain I can master the skills being taught.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always).

Overall, around half of the Australian students reported that they were usually certain they could understand the most difficult materials presented in texts. Compared to non-Indigenous students, fewer Indigenous students reported confidence in their ability to master skills or to do well on assignments. No significant differences were found between Indigenous females and males on the items related to general self-efficacy (Table 3.13).

Table 3.13 Indigenous and non-Indigenous students' reports on general self-efficacy

Items about general self-efficacy	Percentage of students who apply themselves often or almost always			
	non-Indigenous	Indigenous		
		All	Females	Males
I'm certain I can understand the most difficult material presented in texts	45	51	49	53
I'm confident I can do an excellent job on assignments and tests	**64**	**54**	48	61
I'm certain I can master the skills being taught	**60**	**54**	51	58

The general self-efficacy index was created using these three items. In line with the differences in endorsement of the items, non-Indigenous students' average score (0.09) on the general self-efficacy index was significantly higher than that of Indigenous students (-0.04).

Figure 3.12 presents the mean scores for non-Indigenous and Indigenous students, as well as by gender for Indigenous students, on the general self-efficacy index. The mean score on the self-efficacy index for Indigenous females was -0.12 and appeared lower than that of Indigenous males (0.04); however, there was no statistically significant difference between these average scores. On the other hand, among non-Indigenous students, males recorded significantly higher general self-efficacy, on average, than did females, with means of 0.18 and 0.00, respectively.

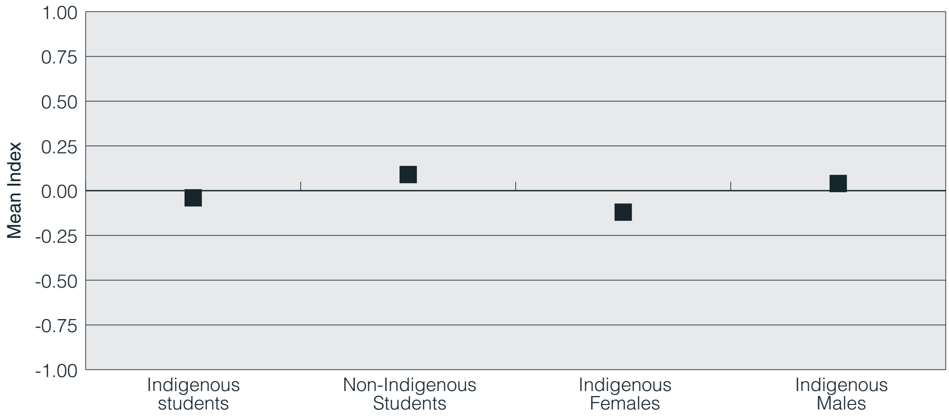

Figure 3.12 Self-efficacy for Indigenous and non-Indigenous students, and Indigenous females and males

Students who scored higher on the general self-efficacy index tended to perform better in the reading literacy assessment. Among both groups of students there was a moderate correlation between general self-efficacy and reading literacy performance. For Indigenous students the correlation was 0.19, while for non-Indigenous students the correlation was 0.23.

Self-efficacy in mathematics

In 2003, PISA measured students' belief in their own ability to handle learning situations in mathematics effectively using items which covered the following topics:

- Using a bus or train timetable to work out how long it would take to get from one place to another,
- Calculating how much cheaper a TV would be after a 30% discount,
- Calculating how many square metres of tiles you need to cover a floor,
- Understanding graphs presented in newspapers,
- Solving an equation like 3x + 5 = 17,
- Finding the actual distance between two places on a map with a 1:10,000 scale,
- Solving an equation like 2(x + 3)=(x + 3)(x - 3), and
- Calculating the petrol consumption rate of a car.

Students were asked how confident they felt about having to do the above eight mathematics tasks on a four-point scale (very confident; confident; not very confident; and not at all confident).

Table 3.14 shows the percentage of Indigenous and non-Indigenous students who were confident or very confident about having to complete various mathematics tasks. While the majority of Indigenous students were confident of their ability to handle these mathematics tasks, overall endorsement of the items was slightly lower among Indigenous students than their non-Indigenous peers. Eighty per cent of Indigenous students were confident about using a bus or train timetable to work out how long it would take to get from one place to another or understanding graphs presented in newspapers, compared to 90 per cent of non-Indigenous students. Seventy per cent of Indigenous students were confident about calculating how much cheaper a TV would be after a 30 per cent discount, compared to 80 per cent of non-Indigenous students.

Fewer students overall felt confident about solving a more complex algebraic equation such as 2(x + 3) = (x + 3)(x - 3), with close to 60 per cent of Indigenous students and 70 per cent of non-Indigenous students reporting being confident in tackling this equation.

There were no significant differences between the proportion of Indigenous and non-Indigenous students who expressed confidence in having to solve the mathematics tasks about calculating petrol consumption, calculating an area or finding a distance between two places on a map.

Significant differences were found in the level of confidence of Indigenous females and males in undertaking three of the mathematics tasks. Indigenous males were more confident than Indigenous females about calculating an area for tiles to cover a floor, calculating the petrol consumption rate of a car or finding the distance between two places on a map.

Table 3.14 Indigenous and non-Indigenous students' reports of self-efficacy in mathematics

Items about self-efficacy in mathematics	Percentage of students who are confident or very confident			
	non-Indigenous	Indigenous		
		All	Females	Males
Using a bus or train timetable to work out how long it would take to get from one place to another	**90**	**79**	77	81
Calculating how much cheaper a TV would be after a 30% discount	**79**	**71**	70	72
Calculating how many square metres of tiles you need to cover a floor	76	70	**65**	**75**
Understanding graphs presented in newspapers	**89**	**79**	76	81
Solving an equation like 3x + 5 = 17	**84**	**72**	69	75
Finding the actual distance between two places on a map with a 1:10,000 scale	59	52	**39**	**63**
Solving an equation like 2(x + 3)=(x + 3)(x - 3)	**68**	**58**	55	61
Calculating the petrol consumption rate of a car	60	59	**49**	**68**

Students' responses to the eight mathematics task questions were used to construct a mathematics self-efficacy index. Indigenous students reported significantly lower mathematics self-efficacy on average compared to non-Indigenous students. The mean for Indigenous students was below the OECD average at -0.21, while the mean for non-Indigenous students on the mathematics self-efficacy index was 0.11 (Figure 3.13).

Significant gender differences in mathematics self-efficacy were found for both Indigenous and non-Indigenous students. Males reported significantly higher confidence in their ability to handle learning situations in mathematics effectively compared to females. Means for Indigenous students were below the OECD average, with a mean score of -0.09 for Indigenous males, and -0.35 for Indigenous females. Among non-Indigenous students, the relative difference between the mathematic self-efficacy scores for males and females was even greater, with non-Indigenous males scoring 0.29 on average and non-Indigenous females scoring –0.08.

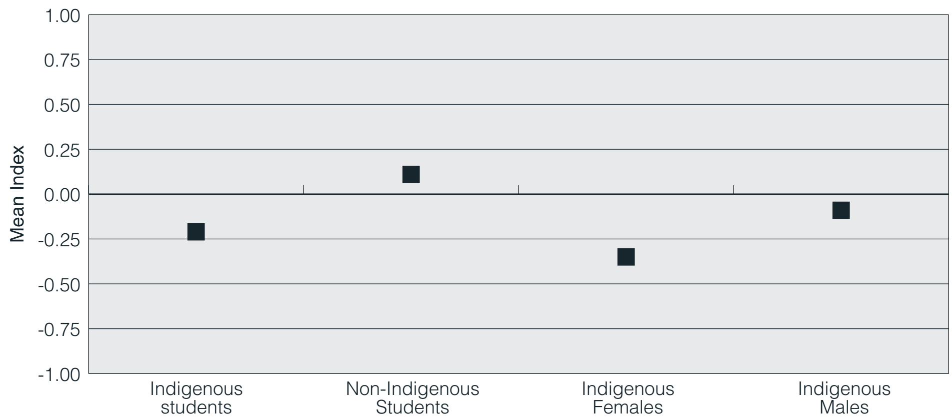

Figure 3.13 Self-efficacy in mathematics for Indigenous and non-Indigenous students, and Indigenous females and males

Of all the factors examined in PISA 2003, mathematics self-efficacy had the strongest association with mathematical literacy performance. The correlation for Indigenous students was 0.40, and for non-Indigenous students the correlation was 0.52; both were significant. Figure 3.14 shows the relationship between quartiles of self-efficacy in mathematics and mathematical literacy performance for Indigenous and non-Indigenous students. The gap in achievement between those in the highest quartile and lowest quartile of the self-efficacy measure was substantial, with a difference of almost 100 points for Indigenous and 137 points for non-Indigenous students.

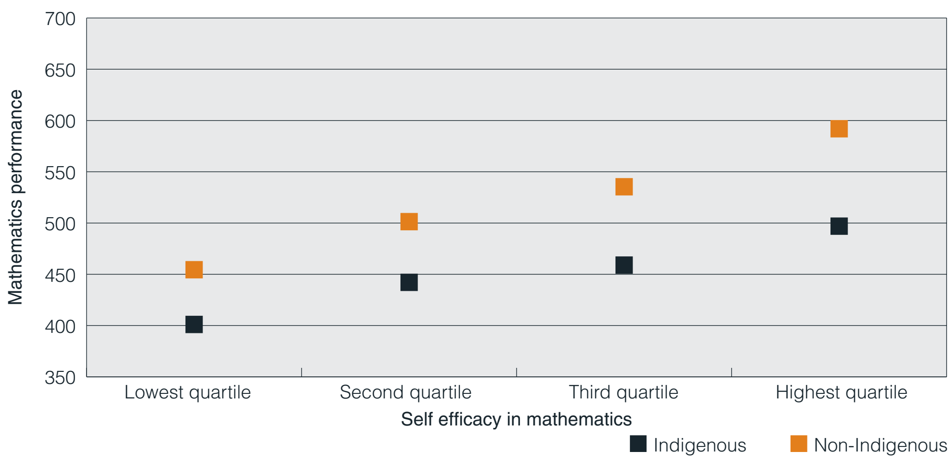

Figure 3.14 Mean mathematical literacy performance scores by quartiles on the self-efficacy index, for Indigenous and non-Indigenous students

Self-efficacy in science

PISA 2006 measured students' confidence in their ability to perform the following science-related tasks:

- Recognise the science question that underlies a newspaper report on a health issue,
- Explain why earthquakes occur more frequently in some areas than in others,
- Describe the role of antibiotics in the treatment of disease,
- Identify the science question associated with the disposal of garbage,
- Predict how changes to an environment will affect the survival of certain species,
- Interpret the scientific information provided on the labeling of food items,

- Discuss how new evidence can lead you to change your understanding about the possibility of life on Mars, and
- Identify the better of two explanations for the formation of acid rain.

Students were asked how easily they thought they would be able to perform the above eight science tasks on a four-point scale (I could do this; I could do this with a bit of effort; I would struggle to do this on my own; and I couldn't do this).

Table 3.15 shows the percentage of Indigenous and non-Indigenous students who were confident or very confident about having to perform various science tasks. Non-Indigenous students were generally more confident in their abilities than Indigenous students, reporting higher levels of confidence on all eight items.

For both groups of students the strongest level of confidence was indicated for three issues: recognising the science question that underlies a health issue reported in the newspaper, explaining why earthquakes occur more frequently in some areas than in others, and predicting how changes to an environment will affect the survival of a certain species. More than three-quarters of non-Indigenous students reported relatively high levels of confidence on such tasks, compared to around 60 per cent of Indigenous students.

The items on which both groups of students expressed least confidence were discussing how new evidence can lead to understanding about the possibility of life on Mars, and identifying the better of two explanations for the formation of acid rain. Around 55 per cent of non-Indigenous students compared to approximately 40 per cent of Indigenous students expressed confidence about these activities.

Significant differences were found in the confidence of Indigenous males and females in performing two of the science tasks. The proportion of Indigenous males who reported high levels of confidence in both predicting how changes to an environment will affect the survival of certain species, and discussing how new evidence can lead to understanding about the possibility of life on Mars, was significantly greater than the corresponding proportion of Indigenous females.

Table 3.15 Indigenous and non-Indigenous students' reports on self-efficacy in science

Items about self- efficacy in science	Percentage of students who are confident or very confident			
	non-Indigenous	Indigenous		
		All	Females	Males
Recognise the science question that underlies a newspaper report on a health issue	**79**	**62**	59	65
Explain why earthquakes more frequently in some areas than in others	**79**	**66**	63	68
Describe the role of antibiotics in the treatment of disease	**60**	**47**	44	49
Identify the science question associated with the disposal of garbage	**62**	**47**	42	51
Predict how changes to an environment will affect the survival of certain species	**76**	**60**	**56**	**63**
Interpret the scientific information provided on the labeling of food items	**68**	**54**	51	58
Discuss how new evidence can lead you to change your understanding about the possibility of life on Mars	**55**	**42**	**37**	**47**
Identify the better of two explanations for the formation of acid rain	**54**	**41**	37	44

Students' responses to the eight science tasks were used to construct a science self-efficacy index. Indigenous students reported significantly lower self-efficacy in science, on average, than non-Indigenous students. The mean for Indigenous students was below the OECD average at -0.35, while the mean for non-Indigenous students on this index was higher than the OECD average, at 0.13 (Figure 3.15).

Significant gender differences in science self-efficacy were not found for Indigenous students, with a mean index of -0.27 for males and -0.43 for females. This is in contrast to the findings for non-Indigenous students, where males reported significantly higher confidence in their ability to perform various science tasks than females, with mean indices of 0.20 and 0.06, respectively.

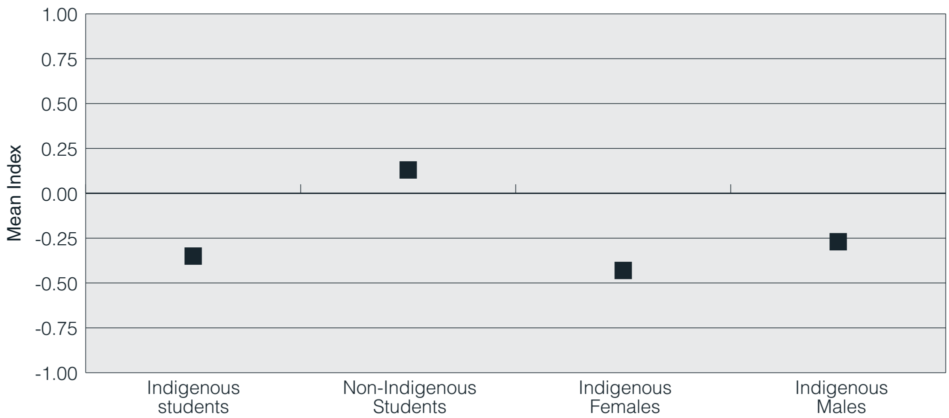

Figure 3.15 Self-efficacy in science for Indigenous and non-Indigenous students, and Indigenous females and males

Similar to the findings for self-efficacy in mathematics in PISA 2003, self-efficacy in science also had the strongest association of all indices with scientific literacy performance in 2006. The correlations were 0.39 for Indigenous students and 0.48 for non-Indigenous students.

General academic self-concept

Having a positive self-concept in relation to academic situations is an important characteristic for students to possess. In PISA 2000, students were asked to respond to the following items, with the aim of measuring their confidence in dealing with school subjects:

- I learn things quickly in most school subjects,
- I'm good at most school subjects, and
- I do well in tests in most school subjects.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Generally, Australian students have a positive academic self-concept. As shown in Table 3.16, over 80 per cent of students agreed or strongly agreed that they learnt things quickly and were good at most school subjects, and 75 per cent agreed or strongly agreed that they did well in tests for most school subjects.

Happily, there were no significant differences in the proportions of Indigenous and non-Indigenous students whose responses were indicative of positive self-concept, nor were there any significant differences between the responses of Indigenous females and males.

Table 3.16 Indigenous and non-Indigenous students' reports of level of academic self-concept

Items about academic self-concept	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I learn things quickly in most school subjects	81	82	78	85
I'm good at most school subjects	84	84	88	80
I do well in tests in most school subjects	76	72	71	74

The PISA 2000 index of general academic self-concept was derived using these items. There were no significant differences between the average scores of Indigenous and non-Indigenous students on the academic self-concept index. The mean score for Indigenous students was 0.03 and for non-Indigenous students was 0.08.

There were no significant differences between the average academic self-concept scores of either Indigenous or non-Indigenous females and males.

There was a positive association between general academic self-concept and reading literacy performance, with a moderate correlation of 0.24 for Indigenous students and a strong correlation of 0.33 for non-Indigenous students.

Self-concept in English

In 2000, information about students' self-concept in English classes was collected by asking them to respond to the following three items:

- I'm hopeless in English lessons,
- I learn things quickly in English lessons, and
- I get good marks in English.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Approximately one-fifth of Australian students reported they agreed or strongly agreed that they are hopeless in English lessons, while in contrast around three-quarters indicated they get good marks and learn things quickly in English (Table 3.17). The response patterns of Indigenous and non-Indigenous students on these items were quite similar. Among Indigenous students, a higher proportion of females (80%) compared to males (68%) agreed or strongly agreed that they learn things quickly in English lessons.

Table 3.17 Indigenous and non-Indigenous students' reports on self-concept in English

Items about self-concept in English	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I'm hopeless in English lessons	18	20	19	22
I learn things quickly in English lessons	73	74	**80**	**68**
I get good marks in English	78	76	78	74

An index of self-concept in English was derived using these three items. The average score on this index for Indigenous students was 0.17, which was not statistically significantly different to that of non-Indigenous students (0.13). Among Indigenous students, females had an average score on the self-concept in English index of 0.23, while males had an average score of 0.17. While there was no statistically significant difference between these means, the pattern is similar to that found among non-Indigenous students, in which females displayed a significantly higher self-concept in English than males, with average scores of 0.18 and 0.09, respectively.

It is of interest to note that the relationship between self-concept in English and reading literacy was not as strong as the relationship between general academic self-concept and reading literacy, reported in the previous section. For non-Indigenous students, the correlation between self-concept in English and reading literacy was 0.12, while for Indigenous students the relationship was even weaker with a correlation of 0.02.

Self-concept in mathematics

Self-concept in mathematics relates to a student's perception of his or her own mathematical competence. PISA 2003 collected information on students' beliefs about their own mathematical competence using the following five items:

- I am just not good at mathematics,
- I get good marks in mathematics,
- I learn mathematics quickly,
- I have always believed that mathematics is one of my best subjects, and
- In my mathematics class, I understand even the most difficult work.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Only around 40 per cent of Australian students agreed that mathematics is one of their best subjects and that they understood the most difficult work in their mathematics class. The proportions of Indigenous and non-Indigenous students who agreed that they got good marks in mathematics (58% and 65%, respectively), or learnt mathematics quickly (58% and 56%, respectively) were quite similar. There was a significant difference in the proportions of Indigenous and non-Indigenous students who agreed to the item "I am just not good at mathematics", with more than four in ten Indigenous students endorsing this item, compared to three in ten non-Indigenous students (Table 3.18).

A significantly greater proportion of Indigenous male students, compared to Indigenous female students, agreed that they learnt mathematics quickly (66% compared to 50%, respectively) or that mathematics was one of their best subjects (41% compared to 33%, respectively). While it appeared that more Indigenous female students agreed that they were just not good at mathematics, there was no statistical difference in the proportions of male and female Indigenous students who endorsed this item.

Table 3.18 Indigenous and non-Indigenous students' reports on self-concept in mathematics

Items about self-concept in mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I am just not good at mathematics	**32**	**44**	49	41
I get good marks in mathematics	65	58	53	63
I learn mathematics quickly	56	58	**50**	**66**
I have always believed that mathematics is one of my best subjects	38	37	**33**	**41**
In my mathematics class, I understand even the most difficult work	38	37	36	39

The items about students' beliefs in their own mathematical competence were used to construct an index of self-concept in mathematics. A more positive score of the index indicated a more positive level of confidence. The average scores of Indigenous and non-Indigenous students on the self-concept in mathematics index were significantly different, with Indigenous students scoring 0.04 and non-Indigenous students 0.13, on average. The means for Indigenous and non-Indigenous students were significantly higher than the OECD average.

On average, male students were significantly more confident than female students in their ability to undertake mathematics tasks. Indigenous males scored 0.14 on average on the self-concept in mathematics index, compared to an average of -0.08 for Indigenous females. The mean for non-Indigenous males on the self-concept in mathematics index was 0.29, compared to a mean of -0.02 for non-Indigenous females (Figure 3.16).

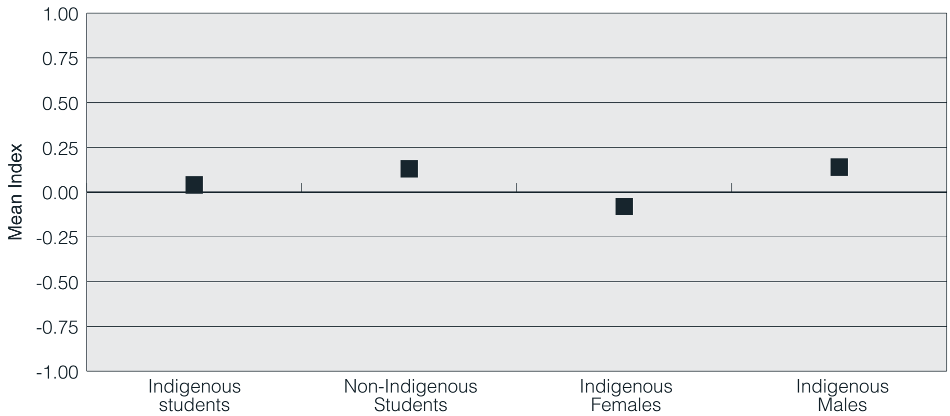

Figure 3.16 Self-concept in mathematics for Indigenous and non-Indigenous students, and Indigenous females and males

Self-concept in mathematics had a moderately positive relationship with mathematical literacy performance. Among Indigenous students, the correlation between self-concept in mathematics and mathematical literacy was 0.23 while for non-Indigenous students the relationship was stronger, with a correlation of 0.41. Figure 3.17 shows the relationship between self-concept in mathematics and mathematical literacy performance with 73 and 103 score points difference, on average, between the highest and lowest quartiles in the self-concept in mathematics index for Indigenous and non-Indigenous students, respectively.

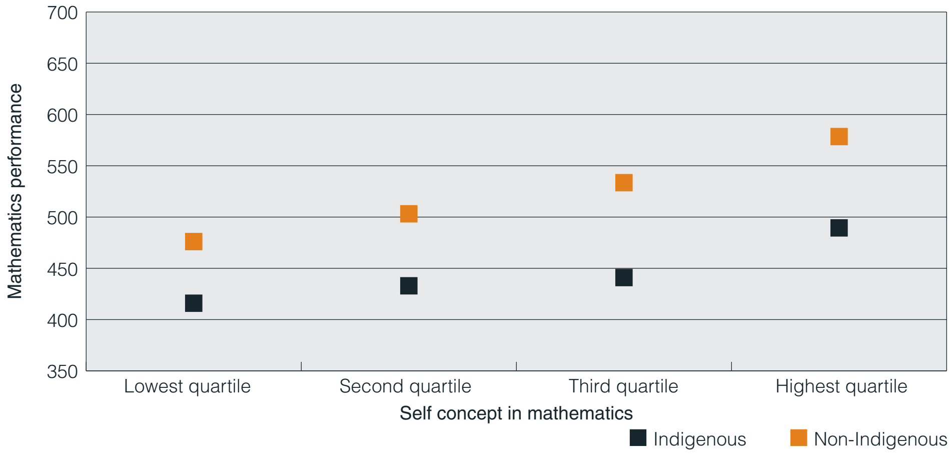

Figure 3.17 Mean mathematical literacy performance scores by quartiles on the self-concept in mathematics index, for Indigenous and non-Indigenous students

Self-concept in science

If students believe in their own capabilities, they will be more willing to make the necessary investments in learning. In PISA 2006, data was collected on student's beliefs about competence in science using the following items:

- Learning advanced science topics would be easy for me,
- I can usually give good answers to test questions on science topics,
- I learn science topics quickly,
- Science topics are easy for me, and
- When I am being taught science, I can understand the concepts very well.

Students indicated the extent to which they agreed with each of these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Non-Indigenous students generally indicated a stronger level of self-concept than Indigenous students (Table 3.19). Most students agreed that they usually give good answers to test questions on science: two-thirds of non-Indigenous students agreed or strongly agreed with this item, compared to just half of Indigenous students. In contrast, forty per cent of non-Indigenous students compared to just over 30 per cent of Indigenous students indicated that learning advanced science topics would be easy for them.

Amongst Indigenous students, significantly greater proportions of males than females agreed that learning advanced science topics would be easy for them or that they learn science topics quickly.

Table 3.19 Indigenous and non-Indigenous students' reports of science self-concept

Items about self-concept in science	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
Learning advanced science topics would be easy for me	**40**	**32**	**26**	**38**
I can usually give good answers to test questions on science topics	**67**	**51**	50	52
I learn science topics quickly	**56**	**45**	**40**	**49**
Science topics are easy for me	**48**	**39**	36	41
When I am being taught science, I can understand the concepts very well	**60**	**52**	50	54

Students' responses to the five items were used to construct a self-concept in science index. Indigenous students recorded, on average, significantly lower levels of self-concept in science than non-Indigenous students. The mean for Indigenous students was below the OECD average at -0.26, while the mean for non-Indigenous students was not significantly different to the OECD average at -0.03 (Figure 3.18).

On average, male students reported a significantly higher level of confidence in their capabilities to learn science than did female students. For Indigenous students, the average level of self-confidence expressed was -0.14 for males and -0.35 for females. The average score for females was significantly lower than the OECD average on this index. The mean for non-Indigenous males on the self-concept in science index was 0.08, compared to a mean of -0.14 for non-Indigenous females.

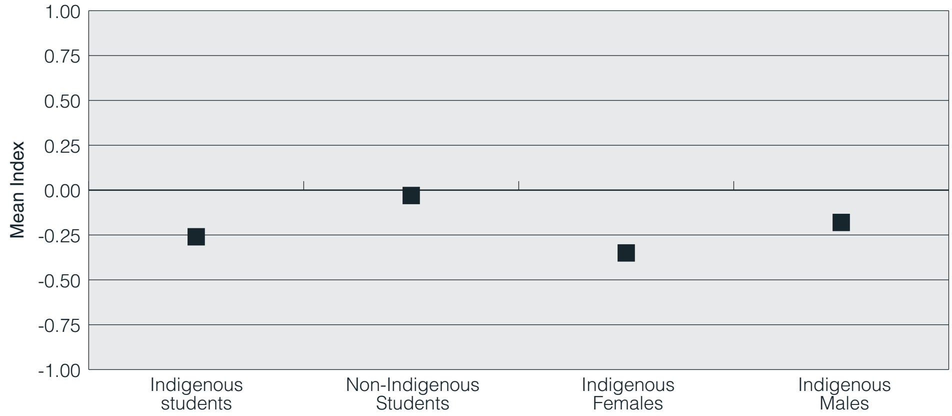

Figure 3.18 Self-concept in science for Indigenous and non-Indigenous students, and Indigenous females and males

Students who scored higher on the self-concept in science index tended to be those who performed better in scientific literacy. Among Indigenous students, the correlation between self-concept in science and scientific literacy performance was 0.20, while for non-Indigenous students the correlation was stronger at 0.43. The correlations between the self-concept in science index and scientific literacy for Indigenous and non-Indigenous students were significant. When this relationship was explored further, it was found that Indigenous students in the highest quartile of self-concept in science scored 54 points higher, on average, than Indigenous students in the lowest quartile on the index. This score point difference was under half of that found for non-Indigenous students, where the difference between students in the highest and lowest quartile was, on average, 113 score points (Figure 3.19).

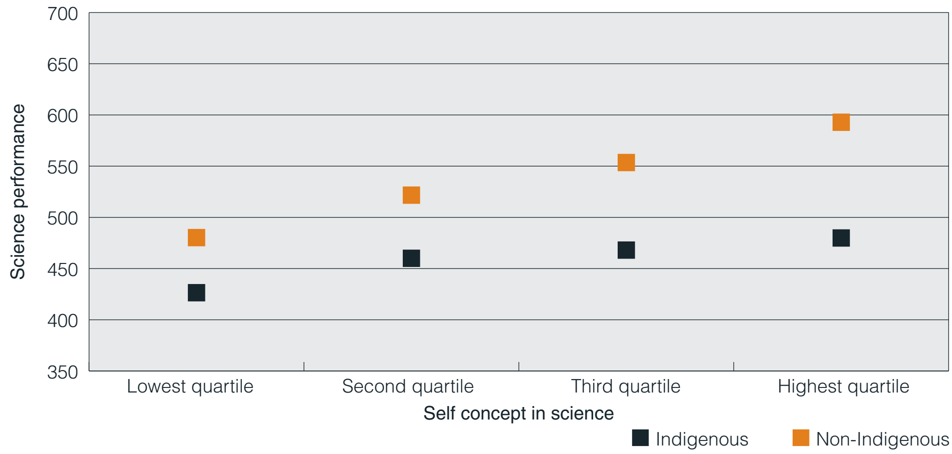

Figure 3.19 Mean scientific literacy performance scores by quartiles on the self-concept in science index, for Indigenous and non-Indigenous students

Control expectations

Control expectations refer to a person's beliefs about the relationship between behaviour and subsequent outcomes. PISA has defined this construct as control expectations, but it is also more generally known as internal locus of control. Students with high levels of control expectations (or an internal locus of control) believe that they can exert control over their learning behaviour in order to achieve positive results.

In PISA 2000, the following four items were used to collect information about student's use of control expectations for learning:

- When I sit myself down to learn something really difficult, I can learn it,
- If I decide not to get any bad marks, I can really do it,
- If I decide not to get any problems wrong, I can really do it. and
- If I want to learn something well, I can.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always).

Table 3.20 shows the percentages of non-Indigenous and Indigenous students, and Indigenous females and males, who often or almost always reported control over different aspects of their learning. Approximately half the Australian students in PISA 2000 believed that they could learn something that was very difficult if they applied themselves, and that if they decided not to get any problems wrong, they could achieve this result. About two-thirds of Australian students reported if they decided not to get any bad marks, they could often or almost always manage to achieve this outcome. A significantly higher proportion of non-Indigenous students (71%) than Indigenous students (64%), reported they could learn something well if they wanted to do so.

Indigenous females and males were similar in their responses to the items about control expectations.

Table 3.20 Indigenous and non-Indigenous students' reports of control expectations

Items about control expectations	Percentage of students who apply themselves often or almost always			
	non-Indigenous	Indigenous		
		All	Females	Males
When I sit myself down to learn something really difficult, I can learn it	56	50	52	48
If I decide not to get any bad marks, I can really do it	66	64	63	65
If I decide not to get any problems wrong, I can really do it	47	50	43	57
If I want to learn something well, I can	**71**	**64**	64	64

The control expectations index was constructed using student responses to these items. Higher positive values indicate a perceived higher level of control over learning and performance. In general, Indigenous students had lower expectations of control over their learning than non-Indigenous students, with means on the index of -0.12 and -0.05, respectively.

There were no significant differences in the control expectations of Indigenous females and males; Indigenous females had a mean score of -0.11 and Indigenous males had a mean score of -0.13 on the index of control expectations. There were, however, significant gender differences found between non-Indigenous females and males. Non-Indigenous females, with a mean score of -0.09 had lower expectations of control over their learning than did non-Indigenous males, with a mean score of -0.01.

There was a positive association between control expectations and reading literacy performance. The correlations among Indigenous and non-Indigenous students were 0.17 and 0.23, respectively, indicating that for both groups of students, higher expectations of control (or feelings of internal locus of control) were associated with higher scores in the reading literacy assessment.

Mathematics anxiety

In addition to assessing self-efficacy and self-concept, a third dimension of self-related beliefs, relating to emotional factors, was assessed in PISA 2003. This construct is associated with feelings of helplessness and emotional stress when dealing with mathematics.

Students can perceive mathematics in general, or particular mathematical tasks, as being potentially intimidating. Subsequently, students may feel helpless and uneasy and this, in turn, can affect their motivation, their persistence and their performance in mathematics.

In PISA 2003, students were asked about their feelings of helplessness and the emotional stress they experience when dealing with mathematics using the following items:

- I often worry that it will be difficult for me in mathematics classes,
- I get very tense when I have to do mathematics homework,
- I get very nervous doing mathematics problems,
- I feel helpless when doing a mathematics problem, and
- I worry that I will get poor marks in mathematics.

Students indicated how strongly they agreed (on a four-point scale: strongly agree; agree; disagree; and strongly disagree) with these items.

Table 3.21 shows the percentage of Indigenous and non-Indigenous students who agreed or strongly agreed with these items. Generally, Indigenous students reported significantly higher levels of agreement with these items compared to non-Indigenous students. Approximately one-third of Indigenous students, compared to one-fifth of non-Indigenous students, agreed (or strongly agreed) that they get very nervous when doing mathematics or that they feel helpless when doing a mathematics problem. The proportion of Indigenous students (41%) who agreed that they get tense while doing mathematics homework was significantly greater than the corresponding proportion of non-Indigenous students who endorsed this item (27%); however, the proportions of Indigenous and non-Indigenous students who indicated that they worried about getting poor marks in mathematics were very similar. The responses of Indigenous male and female students to the mathematics anxiety items were quite similar, which is in contrast to their responses to the mathematic self-concept items reported earlier.

Table 3.21 Indigenous and non-Indigenous students report of mathematics anxiety

Items about mathematics anxiety	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I often worry that it will be difficult for me in mathematics classes	**53**	**62**	64	61
I get very tense when I have to do mathematics homework	**27**	**41**	37	44
I get very nervous doing mathematics problems	**22**	**31**	35	28
I feel helpless when doing a mathematics problem	**20**	**30**	30	30
I worry that I will get poor marks in mathematics	58	64	70	58

The index of mathematics anxiety was derived from students' responses to the five items. The higher the score on the mathematics anxiety index, the more anxious students' experience in mathematics. Indigenous students recorded significantly higher levels of mathematics anxiety than non-Indigenous students, with means of 0.18 and -0.06, respectively. Unsurprisingly, given their response profiles to the individual items (presented in Table 3.22), there were no significant differences in the average levels of mathematics anxiety recorded by Indigenous males (0.08) and females (0.28). Among non-Indigenous students, however, females scored significantly higher on the mathematics anxiety index (0.08) compared to males (-0.19). Figure 3.20 shows the means for Indigenous and non-Indigenous students by gender on the mathematics anxiety index.

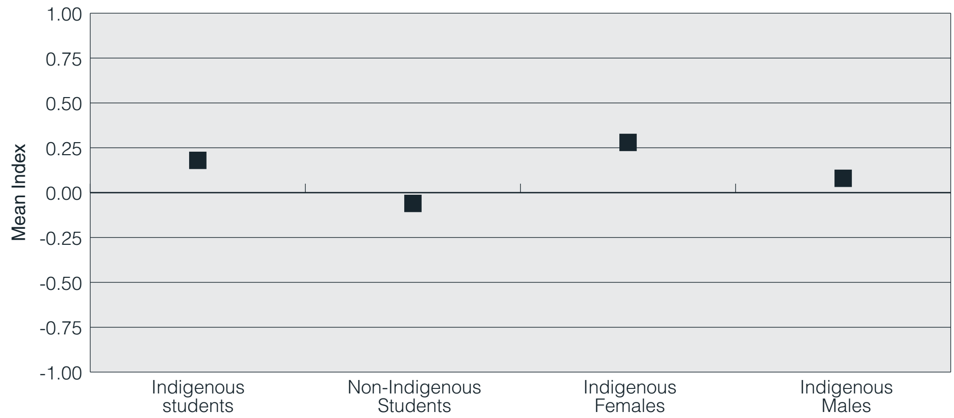

Figure 3.20 Mathematics anxiety for Indigenous and non-Indigenous students, and Indigenous females and males

There was a significant negative association between mathematics anxiety and mathematical literacy performance, indicating that students with higher levels of mathematics anxiety exhibited lower levels of performance in mathematical literacy. For Indigenous students, a correlation of -0.24 was found, while for non-Indigenous students the correlation was -0.35.

Figure 3.21 presents the average mathematical literacy scores for Indigenous and non-Indigenous students grouped according to their mathematics anxiety scale index scores. The difference in the average mathematical literacy scores for students in the highest and lowest quartiles on the mathematics anxiety index was, on average, 57 score points for Indigenous students and 88 score points, on average, for non-Indigenous students.

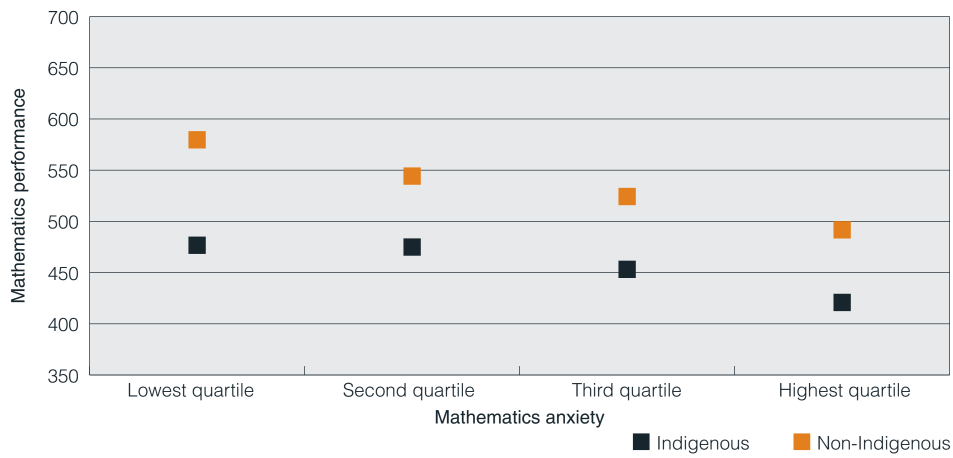

Figure 3.21 Mean mathematics literacy performance scores by quartiles on the mathematics anxiety index, for Indigenous and non-Indigenous students

Summary

This chapter has focused on the attitudes, engagement, motivation and beliefs of Indigenous and non-Indigenous students as measured in PISA.

Of concern to educators will be the lack of confidence and engagement that is reflected in the responses of Indigenous students on the PISA questions. In order to improve achievement, the root causes of lack of engagement, lack of interest, lack of confidence, and lack of self-efficacy need to be addressed.

The next chapter of this report examines how Indigenous and non-Indigenous students manage their own learning process and the learning strategies they use.

Chapter 4

Learning strategies and preferences

Key findings

- Compared to non-Indigenous students, Indigenous students reported:
  - more frequent use of elaboration strategies for learning mathematics
  - less frequent use of control strategies for learning mathematics
  - less preference for competitive learning situations
- Indigenous females reported more frequent use of control strategies for learning mathematics and a stronger preference for cooperative learning situations than Indigenous males.

Learning continues throughout life and each individual must have strategies to manage their own learning and integrate new skills and knowledge once they have completed their 'formal' education. PISA assesses a range of learning strategies, preferences and behaviours that are relevant to all areas of study during, and beyond, formal schooling.

Learning Strategies

Students who have the ability to manage their own learning are able to choose appropriate learning goals, use existing knowledge and skills to foster their learning, and select learning strategies for the task at hand. The ability to employ a range of different strategies to improve learning is an important outcome in education in and of itself, as well as through the positive influence it can have on achievement and performance.

Memorisation strategies for general learning

Memorisation strategies include rote learning of facts or rehearsal of examples that are stored in the memory with little or no further processing. These do not generally lead to a deeper understanding. In PISA 2000, students were asked about their use of memorisation strategies in their general learning using the following items:

When I study…

- I try to memorise everything that might be covered,
- I memorise as much as possible,
- I memorise all new material so that I can recite it, and
- I practise by saying the material to myself over and over.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always).

As shown in Table 4.1, Indigenous and non-Indigenous students reported similar levels of using memorisation strategies in their general learning. Almost 70 per cent of Australian students report trying to memorise 'as much as possible' and almost 60 per cent of Australian students try to memorise 'everything that might be covered' when they study. Use of recitation and repetition type techniques were less common, with less than half of the students often or always often using these strategies when they studied. There were no significant differences between the responses of non-Indigenous and Indigenous students, nor were there any significant differences in the reported use of memorisation strategies by Indigenous females and males.

Table 4.l Indigenous and non-Indigenous students' report of memorisation strategies for general study

Items about memorisation strategies	Percentage of students who use these strategies often or almost always			
		Indigenous		
When I study:	non-Indigenous	All	Females	Males
I try to memorise everything that might be covered	57	57	56	57
I memorise as much as possible	69	66	68	64
I memorise all new material so that I can recite it	35	38	33	43
I practise by saying the material to myself over and over	47	44	45	44

The index of memorisation strategies was constructed using the items above, with higher positive values indicating more frequent use of memorisation strategies when students studied. The average scores for Indigenous and non-Indigenous students were higher than the OECD average, and were very similar, at 0.14 and 0.15, respectively. There were no significant differences found between the average scores for Indigenous females (0.19) and Indigenous males (0.10) on the memorisation strategies index, nor was there a significant difference between the average scores of non-Indigenous male and female students.

Use of memorisation tended to be weakly, but positively associated with reading literacy performance, with more frequent use of memorisation for general study being associated with higher reading literacy scores. The correlations between scores on the memorisation for general study index and reading literacy scores were 0.14 for Indigenous students and 0.09 for non-Indigenous students.

Memorisation strategies for learning mathematics

In PISA 2003, when the main focus of the PISA assessment was mathematics, students were asked to think about the different ways they studied mathematics and to what extent they agreed, using a four-point scale (strongly agree; agree; disagree; and strongly disagree) with the follow items:

- I go over some problems in mathematics so often that I feel as if I could solve them in my sleep,
- When I study for mathematics, I learn as much as I can off by heart,
- In order to remember the method for solving a mathematics problem, I go through examples again and again, and
- To learn mathematics, I try to remember every step in a procedure.

The majority of Australian students agreed or strongly agreed that they learn mathematics by trying to remember every step in a procedure. Over 60 per cent of Australian students reported going through examples repeatedly in order to remember the method for solving a mathematics problem, learning as much as they can 'off by heart'. There were no significant differences in the responses of Indigenous and non-Indigenous students to the items about use of memorisation strategies in learning mathematics (Table 4.2).

Indigenous females and males reported similar use of memorisation strategies for learning mathematics, apart from responses to one item — there were significantly more Indigenous males (46%) compared to Indigenous females (26%) who agreed or strongly agreed they go over mathematics problems so often that they feel they could solve them in their sleep.

Table 4.2 Indigenous and non-Indigenous students' report of memorisation strategies for learning mathematics[10]

Items about memorisation/rehearsal learning strategies for learning mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I go over some problems in mathematics so often that I feel as if I could solve them in my sleep	30	37	**26**	**46**
When I study for mathematics, I learn as much as I can off by heart	64	66	65	67
In order to remember the method for solving a mathematics problem, I go through examples again and again	71	66	70	63
To learn mathematics, I try to remember every step in a procedure	80	83	85	80

The index of memorisation strategies for learning mathematics was derived from the above items. A higher positive score on this index indicates that students use memorisation strategies more often for learning mathematics than students who have achieved a lower score. There were no significant differences between the average scores of Indigenous and non-Indigenous students on the index for memorisation strategies; the mean score for both of these groups of students was 0.17 and above the OECD average.

There were no significant differences between the average scores of Indigenous females (0.13) and Indigenous males (0.21) on this index, nor was there a significant difference between the average scores of non-Indigenous males and females. There was very little association between memorisation strategies and mathematical literacy performance, with correlation coefficients of 0.10 for Indigenous students and 0.04 for non-Indigenous students.

Elaboration strategies for general learning

Elaboration strategies involve a student integrating new information with their existing knowledge base or prior learning by exploring how the material relates to things learned in other contexts, or how the information could be applied in other contexts. In PISA 2000, students were asked to respond to four items about using elaboration strategies for learning:

- When I study, I try to relate new material to things I have learned in other subjects,
- When I study, I think about how the information might be useful in the real world,
- When I study, I try to understand the material better by relating it to things I already know, and
- When I study, I work out how the material fits in with what I have already learned.

Students were asked to indicate how often they used these strategies on a four-point scale (almost never; sometimes; often; and almost always).

Approximately half of the Australian students reported that they often or almost always try to relate new material to things they have learned in other subjects, and that they think about how

10 Throughout this chapter, values in bold indicate statistically significant differences between either non-Indigenous and Indigenous students or Indigenous females and males.

the information might be useful in the real world. A slightly higher proportion often or almost always try to understand the material better by relating it to things they already know, and work out how the material fits in with what they have already learned. Table 4.3 shows that Indigenous and non-Indigenous report using elaboration strategies for learning with similar frequencies, as do Indigenous females and males.

Table 4.3 Indigenous and non-Indigenous students' report of use of elaboration strategies for general learning

Items about elaboration strategies	Percentage of students who apply themselves often or almost always			
	non-Indigenous	Indigenous		
When I study:		All	Females	Males
I try to relate new material to things I have learned in other subjects	47	46	39	54
I think about how the information might be useful in the real world	46	44	43	45
I try to understand the material better by relating it to things I already know	58	57	50	63
I work out how the material fits in with what I have already learned	56	53	49	56

The index of elaboration strategies was derived using students' responses to the four items listed above. Higher positive values on the index indicate more frequent use of elaboration strategies for general study. The average scores of Indigenous (0.04) and non-Indigenous (0.07) students were both above the OECD average on this index.

There was a tendency for female students to report less frequent use of elaboration strategies compared to their male peers. Among Indigenous students, the average scores of females (-0.03) and males (0.11) on the elaboration strategies index were not significantly different, while among non-Indigenous students, males scored higher on average than females did, with mean scores of 0.12 and 0.02, respectively.

Frequent use of elaboration strategies tended to be positively associated with better performance on the reading literacy scale. The correlations between the elaboration strategies index and reading performance among Indigenous students and non-Indigenous students were 0.15 and 0.13, respectively.

Elaboration strategies for learning mathematics

In PISA 2003, students were asked about their use of elaboration as a learning strategy for mathematics. Students were asked to indicate the extent to which they agreed (on a four-point scale of strongly agree, agree, disagree and strongly disagree) with the following items:

- When I am solving mathematics problems, I often think of new ways to get the answer,
- I think how the mathematics I have learnt can be used in everyday life,
- I try to understand new concepts in mathematics by relating them to things I already know,
- When I am solving a mathematics problem, I often think about how the solution might be applied to other interesting questions, and
- When learning mathematics, I try to relate the work to things I have learnt in other subjects.

Indigenous students were more likely than non-Indigenous students to endorse the use of these elaboration strategies (Table 4.4). Indigenous students, more than non-Indigenous students, often thought of new ways to get the answer when solving a mathematics problem and that they think how mathematics can be applied to everyday life. In particular, Indigenous students reported using strategies such as relating problems back to familiar situations and to problems they already knew.

Indigenous females and males reported using elaboration strategies for learning mathematics in fairly similar ways on all but two of the items shown in Table 4.4. Significantly more Indigenous males (72%) thought about how the mathematics they have learnt can be used in everyday life compared to Indigenous females (61%). There were also significantly more Indigenous males (60%) who think about how a mathematics problem might be applied to other interesting questions compared to Indigenous females (42%).

Table 4.4 Indigenous and non-Indigenous students' report of elaboration strategies for learning mathematics

Items about elaboration strategies for learning mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
When I am solving mathematics problem, I often think of new ways to get the answer	**53**	**64**	60	68
I think how the mathematics I have learnt can be used in everyday life	**55**	**67**	**61**	**72**
I try to understand new concepts in mathematics by relating them to things I already know	65	71	69	73
When I am solving a mathematics problem, I often think about how the solution might be applied to other interesting questions	**41**	**52**	**42**	**60**
When learning mathematics, I try to relate the work to things I have learnt in other subjects	**44**	**56**	50	62

The elaboration strategies index was constructed using responses to these five items. On average, Indigenous students used elaboration strategies more frequently in learning mathematics than did their non-Indigenous peers, with mean scores on the index of 0.27 and 0.06, respectively.

There was no significant difference in the use of elaboration strategies for learning mathematics by Indigenous females (0.18) and males (0.35). Non-Indigenous females (-0.09) scored significantly lower on average on the elaboration strategies for learning mathematics index than their male counterparts (0.20).

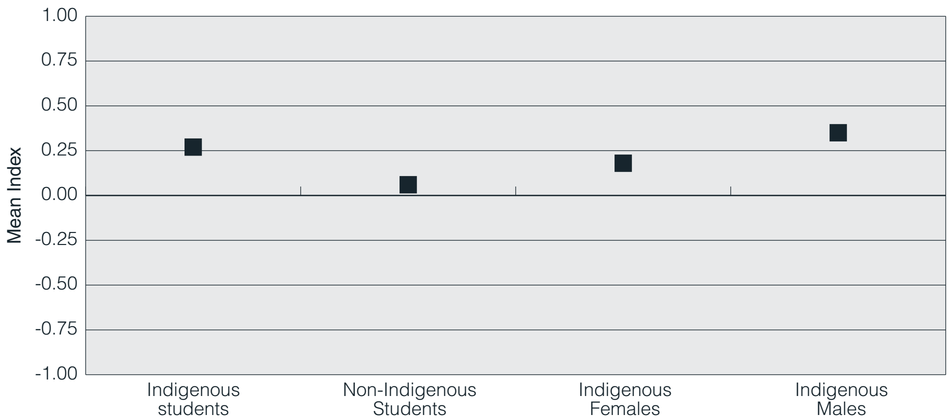

Figure 4.1 Elaboration strategies for learning mathematics, for Indigenous and non-Indigenous students, and Indigenous females and males

While use of elaboration strategies for general study was positively associated with performance in reading literacy in PISA 2000, greater use of elaboration strategies for learning mathematics was not associated with mathematical literacy in PISA 2003.

Control strategies for general learning

Control strategies for general learning relate to the ways in which students plan, monitor and regulate their own learning. Students are active participants in their learning process and they construct meaning by using their prior knowledge and new experiences, and employing strategies to direct and manage their learning.

PISA 2000 measured students' use of control strategies in general study using the following items:

When I study…

- I start by working out exactly what I need to learn,
- I force myself to check to see if I remember what I have learned,
- I try to work out which concepts I still haven't really understood,
- I make sure that I remember the most important things, and
- When I don't understand something, I look for additional information to clarify this.

Students were asked to indicate how often these things occurred on a four-point scale (almost never; sometimes; often; and almost always).

Table 4.5 shows the percentages of students who reported using different control strategies often or almost always when learning. In general, there were few differences between the levels of endorsement of different strategies. The most commonly used strategies by all students were to focus on remembering the most important things, and to work out what it was they needed to learn.

A significantly higher proportion of non-Indigenous students (59%) than their Indigenous peers (52%) reported more frequently that they plan and regulate their learning by attempting to identify the concepts that they don't understand—a control strategy that focuses more on gaps in knowledge and understanding than the other strategies investigated.

Table 4.5 Indigenous and non-Indigenous students' report of control strategies for general study

Items about control strategies	Percentage of students who apply themselves often or almost always			
		Indigenous		
When I study…	non-Indigenous	All	Females	Males
I start by working out exactly what I need to learn	64	62	64	59
I force myself to check to see if I remember what I have learned	53	50	54	46
I try to work out which concepts I still haven't really understood	**59**	**52**	50	55
I make sure that I remember the most important things	75	70	72	68
When I don't understand something, I look for additional information to clarify this	54	51	49	54

The index of control strategies for learning was constructed from students' responses to these five items so that students with a higher positive score used control strategies to learn more frequently than students with a lower score on the index. There were no significant differences in the frequency with which Indigenous and non-Indigenous students employed control strategies in their general study, with mean scores of -0.06 and 0.02, respectively, on the index (Figure 4.2).

While there was a tendency for females to score higher on the control strategies index than their male peers, suggesting that they use control strategies when studying more frequently than do male students, the difference in mean scores was statistically significant only among non-Indigenous students. Non-Indigenous females scored 0.09 on average, compared to -0.05 for non-Indigenous males. There was no statistically significant difference between the average scores of Indigenous females (0.03) and Indigenous males (-0.17) on the control strategies index.

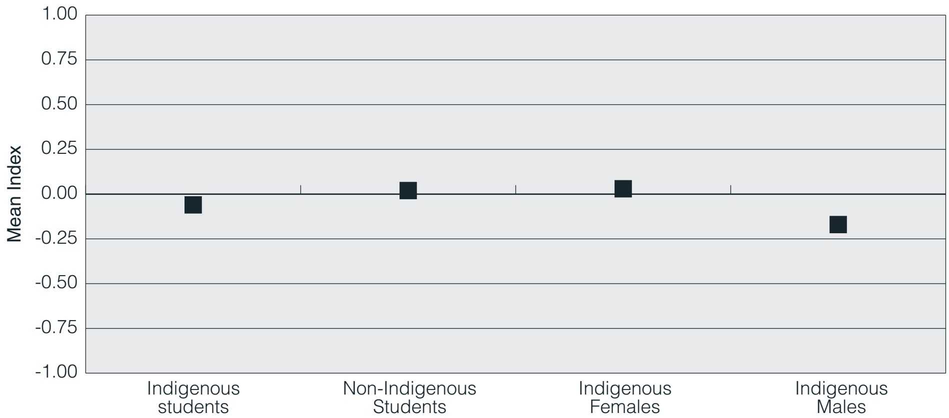

Figure 4.2 Control strategies for Indigenous and non-Indigenous students, and Indigenous females and males

The relationship between control strategies and reading literacy performance was one of the strongest associations found in the learning strategies as measured in PISA. Students who used control strategies for learning more frequently tended to perform better in reading literacy than those who did not. The correlation among Indigenous students was 0.21. The correlation between scores on the control strategies index and on the reading literacy assessment among non-Indigenous students was 0.25.

Control strategies for learning mathematics

In PISA 2003, control strategies for learning mathematics were measured using the following items:

- When I study for a mathematics test, I try to work out what are the most important parts to learn,
- When I study mathematics, I make myself check to see if I remember the work I have already done,
- When I study mathematics, I try to figure out which concepts I still have not understood properly,
- When I cannot understand something in mathematics, I always search for more information to clarify the problem, and
- When I study mathematics, I start by working out exactly what I need to learn.

Students were asked to think about the different ways they studied mathematics and to what extent they agreed with the items, on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

The two strategies identified as most important by all students, regardless of Indigenous status, were attempting to isolate concepts that had not been fully understood, and trying to isolate what it was most important to focus on. Both of these are sensible strategies, but favoured by significantly more non-Indigenous than Indigenous students.

A higher proportion of female Indigenous students, compared to male Indigenous students, indicated that they would attempt to identify the most important parts to study for a mathematics test.

Table 4.6 Indigenous and non-Indigenous students' report of control strategies for learning mathematics

Items about control learning strategies for learning mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
When I study for a mathematics test, I try to work out what are the most important parts to learn	**89**	**83**	**90**	**76**
When I study mathematics, I make myself check to see if I remember the work I have already done	77	78	79	76
When I study mathematics, I try to figure out which concepts I still have not understood properly	**86**	**80**	83	77
When I cannot understand something in mathematics, I always search for more information to clarify the problem	69	67	66	68
When I study mathematics, I start by working out exactly what I need to learn	79	76	80	72

The PISA 2003 index of control strategies for learning mathematics was derived from these items. The mean score for Indigenous students (-0.14) was significantly lower than the mean score recorded by non-Indigenous students (0.01), indicating that, on average, Indigenous students identify using control strategies for learning mathematics less frequently than non-Indigenous students.

Overall, female students scored significantly higher, on average, on the control strategies for learning mathematics index compared to male students. Indigenous females had a mean of -0.05 compared to -0.23 for Indigenous males. For non-Indigenous females and males, the means on the control strategies index were 0.05 and -0.02, respectively (Figure 4.3).

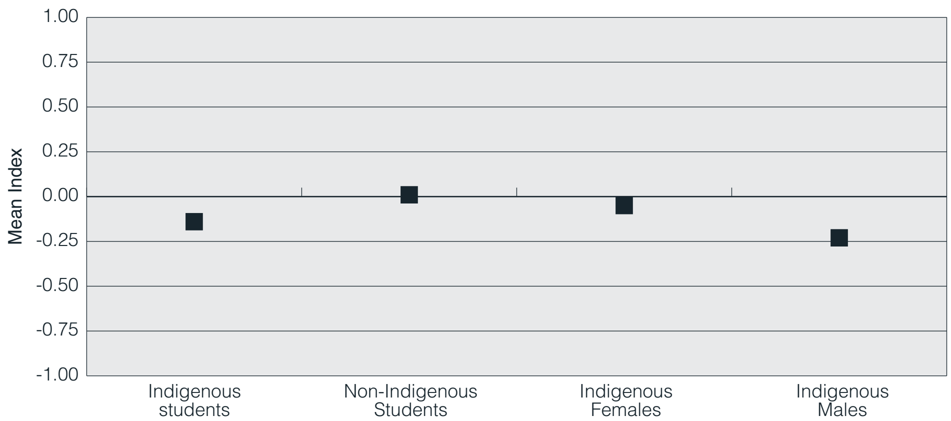

Figure 4.3 Control strategies for learning mathematics, for Indigenous and non-Indigenous students, and Indigenous females and males

While there was a positive relationship between use of control strategies for learning mathematics and performance in mathematical literacy, this relationship was not as strong as that found between use of control strategies for general learning and reading literacy performance in PISA 2000 (see previous section). Among Indigenous students, the correlation between use of control strategies for studying mathematics and mathematical literacy was 0.13, while for non-Indigenous students the correlation was 0.15.

Preferences for learning situations

The previous section reported on students' use of different strategies for learning and the ways they can influence their own learning. In this section, the focus moves to situational factors that can affect students' performance, specifically their preferences for particular learning environments.

PISA collects information about student's preferences for two learning environments or situations–competitive and cooperative learning. Competitive learning refers to students being motivated to perform at a higher level than their peers, whereas cooperative learning relates to the extent a student prefers to work with others when learning. The classroom environment is often one where a combination of competitive and cooperative learning is seen. In some cases, students must work together, depending on one another to complete a task, and in other cases students work in isolation, competing to achieve the highest score or to gain a place in tertiary education.

Preferences for competitive learning situations

In PISA 2000, students were asked if they were competitive in their approach to learning – whether they were conscious of trying to be better than other students. The following items assessed preferences for competitive learning situations:

- I like to try to be better than other students,
- Trying to be better than others makes me work well,
- I would like to be the best at something, and
- I learn faster if I'm trying to do better than others.

Students indicated the extent they agreed with items related to competitive learning on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

There were statistically significant differences in the proportions of Indigenous and non-Indigenous students who endorsed three of these items (Table 4.7). Almost 90 per cent of non-Indigenous students reported that they would like to be the best at something, compared to three-quarters of Indigenous students. Seventy per cent of non-Indigenous students reported that they would like to be better than other students, compared to 62 per cent of Indigenous students, and 63 per cent of non-Indigenous students indicated that trying to be better than others makes them work well compared to half the Indigenous students. Responses to these items suggest that non-Indigenous students may be more competitive in their approach to their learning than Indigenous students.

There was a significantly higher proportion of Indigenous males (71%) who agreed or strongly agreed that they like to try to be better than other students compared to Indigenous females (53%), and that trying to be better than others makes them work well (60% and 45%, respectively).

Table 4.7 Indigenous and non-Indigenous students' preferences for competitive learning situations

Items about about preferences for competitive learning situations	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I like to try to be better than other students	**70**	**62**	**53**	**71**
Trying to be better than others makes me work well	**63**	**52**	**45**	**60**
I would like to be the best at something	**88**	**76**	77	76
I learn faster if I'm trying to do better than others	56	57	53	63

The index of competitive learning was constructed using the responses to the four items listed above. Higher positive values indicated stronger preferences for using competitive learning situations. As expected from the responses to the individual items, non-Indigenous students showed a significantly stronger preference for competitive learning situations than did Indigenous students. The mean score for non-Indigenous students on the index of preference for competitive learning situations was 0.10 compared to the mean score for Indigenous students of 0.04 (see Figure 4.4).

There was a tendency for male students to score higher on the preference for competitive learning situations index than their female peers. Among Indigenous students, there was no statistically significant difference between the mean scores of males (0.01) and females (-0.09). In contrast, the mean score of non-Indigenous males (0.20) was significantly higher than that of non-Indigenous females (0.0).

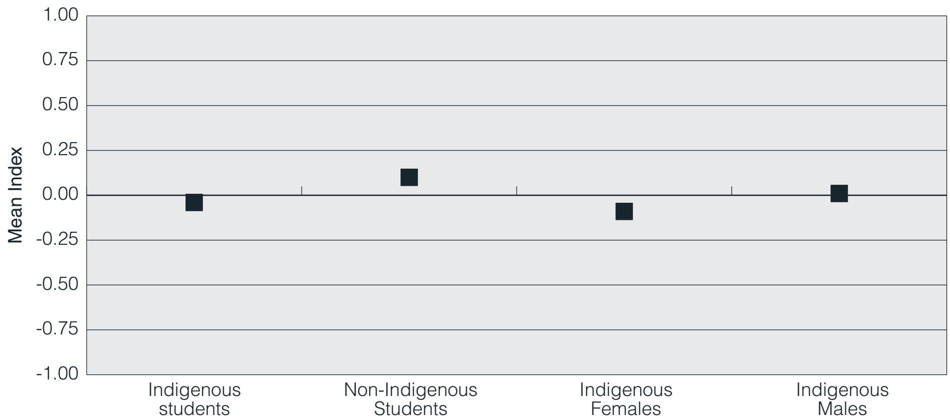

Figure 4.4 Competitive learning strategies for Indigenous and non-Indigenous students, and Indigenous females and males

A preference for competitive learning situations was found to be positively, albeit weakly, associated with reading literacy performance. The relationship between a preference for competitive learning situations and reading literacy performance was slightly stronger among non-Indigenous students, with a correlation of 0.19, than it appeared to be among Indigenous students, with a correlation of 0.12.

Preference for competitive learning situations in mathematics

PISA 2003 measured the preferences of students for competitive learning situations in mathematics with the following items:

- I would like to be the best in my class in mathematics,
- I try very hard in mathematics because I want to do better in tests than the other students,
- I make a real effort in mathematics because I want to be one of the best,
- In mathematics I always try to do better than the other students in my class, and
- I do my best work in mathematics when I try to do better than others.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Indigenous and non-Indigenous students had similar responses to almost all of the items related to their preference for competitive learning situations in mathematics (Table 4.8). A significant difference was found in the responses to one of the items, with more non-Indigenous students (75%), compared to Indigenous students (66%), indicating they would like to be the best in their mathematics class.

Indigenous females and males responded in similar ways to the items about wanting to be the best in their mathematics class, making a real effort to be one of the best, and trying hard in mathematics because they want to do better in tests than other students. However, 60 per cent of

Indigenous males indicated that they agreed or strongly agreed that they always trying to do better than other students in their mathematics class, or trying to do better than others by doing their best work in mathematics, compared to 44 per cent of Indigenous females.

Table 4.8 Indigenous and non-Indigenous students' preferences for competitive learning situations in mathematics

Items about preferences for competitive learning situations in mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I would like to be the best in my class in mathematics	**74**	**66**	65	67
I try very hard in mathematics because I want to do better in tests than the other students	64	69	65	72
I make a real effort in mathematics because I want to be one of the best	59	57	59	55
In mathematics I always try to do better than the other students in my class	51	53	**44**	**61**
I do my best work in mathematics when I try to do better than others	47	54	**43**	**64**

The PISA 2003 index of preference for competitive learning situations in mathematics was derived from students' responses to the five items as listed above. The mean scores on the preference for competitive learning situations in mathematics for Indigenous (0.29) and non-Indigenous students (0.31) were very similar.

The average scores of Indigenous females (0.23) and Indigenous males (0.34) were both statistically higher than the OECD average on the preference for competitive learning situations index, but were not statistically significantly different from one another. There were, however, significant gender differences for non-Indigenous students on the competitive learning situations in mathematics index. Non-Indigenous males (0.43) displayed a stronger preference for competitive learning situations in mathematics in comparison to non-Indigenous females (0.19).

There was a positive relationship found between preferences for competitive learning situations in mathematics classes and performance on the mathematical literacy scale. The associations were not strong, however, with correlations of 0.04 and 0.13 found for Indigenous and non-Indigenous students, respectively.

Preference for cooperative learning situations

Students were asked how much they liked working with and helping other students. The following four items measured students' preferences for cooperative learning situations:

- I like to work with other students,
- I learn most when I work with other students,
- I like to help other people to do well in a group, and
- It is helpful to put together everyone's ideas when working on a project.

Students indicated the extent they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

The majority of Australian students (over 80%) liked to work with other students, considered it helpful to put together everyone's ideas when working on a project, and they like to help other people to do well in a group. Almost three-quarters of students reported learning more when they work with other students. Happily, there were no significant differences in the responses of Indigenous and non-Indigenous students to these items.

Among Indigenous students, females agreed more readily to some items about cooperative learning than did their male peers. Significant gender differences were found on two of the four items relating to cooperative learning. Ninety per cent of Indigenous females liked to help other people to do well in a group compared to 72 per cent of Indigenous males and 88 per cent of Indigenous females indicated it was helpful to put together everyone's ideas when working on a project compared to 78 per cent of Indigenous males (Table 4.9).

Table 4.9 Indigenous and non-Indigenous students' preferences for cooperative learning situations

Items about preferences for cooperative learning situations	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
I like to work with other students	89	92	49	53
I learn most when I work with other students	68	74	71	78
I like to help other people to do well in a group	82	82	**90**	**72**
It is helpful to put together everyone's ideas when working on a project	88	83	**88**	**78**

The index of cooperative learning was constructed using the items above, with higher positive values indicating stronger preferences for cooperative learning. Given the similarity in the responses of Indigenous and non-Indigenous students reported in Table 4.9, it was not surprising to find that the mean scores of these two groups of students on the preference for cooperative learning index were not statistically different. Indigenous students scored 0.06 on average on the index, while non-Indigenous students scored 0.03.

Overall, female students reported a stronger preference for cooperative learning compared to males (Figure 4.5). Indigenous females had a mean of 0.18 compared to -0.06 for Indigenous males. For non-Indigenous females and males, the means on the control strategies index were 0.10 and -0.03, respectively.

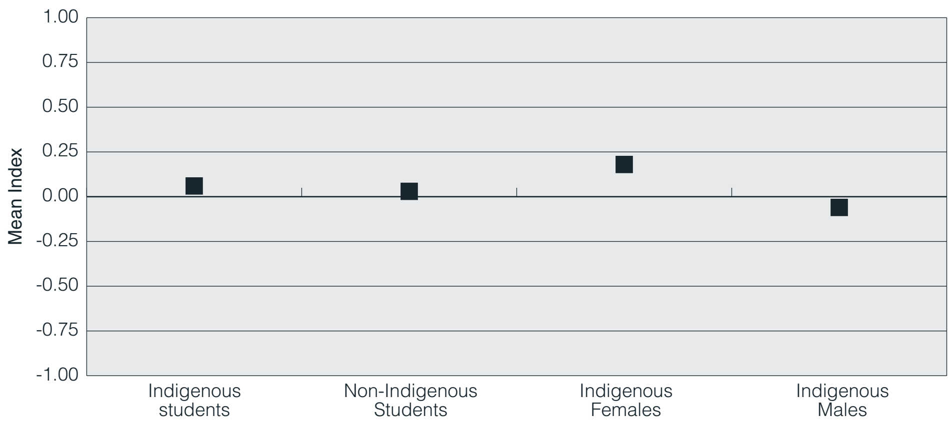

Figure 4.5 Cooperative learning strategies for Indigenous and non-Indigenous students, and Indigenous females and males

There was a positive relationship found between preferences for cooperative learning situations and performance in reading literacy in PISA 2000. This relationship appeared to be slightly stronger among Indigenous students, with a correlation of 0.18, than among non-Indigenous students, with a correlation of 0.05.

Preferences for cooperative learning situations for learning mathematics

In 2003, information was collected about students' preferences for cooperative learning situations in mathematics with the following items:

- In mathematics I enjoy working with other students in groups,
- When we work on a project in mathematics, I think that it is a good idea to combine the ideas of all the students in a group,
- I do my best work in mathematics when I work with other students,
- In mathematics, I enjoy helping others to work well in a group, and
- In mathematics I learn most when I work with other students in my class.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Table 4.10 shows the percentages of Indigenous and non-Indigenous students who agreed or strongly agreed with items related to preferences for cooperative learning situations in mathematics. In general, Indigenous and non-Indigenous students have similar preferences for cooperative learning situations in mathematics. Sixty-three per cent of Australian students indicated they learn most when they work with other students in their mathematics class, and approximately 70 per cent of Australian students reported enjoying helping others to work well in a group in their mathematics classes. Over three-quarters of Australian students reported that in mathematics classes, they enjoy working with other students in groups and think that it's a good idea to combine the ideas of all the students in a group. There were significantly more Indigenous students (70%) who preferred to do their best work in mathematics when they work with other students compared to non-Indigenous students (60%).

Only one of the items related to cooperative learning situations in mathematics showed gender differences for Indigenous students. A significantly greater proportion of Indigenous females (67%) compared to Indigenous males (60%) agreed or strongly agreed that they learn most when they work with other students in their mathematics class.

Table 4.10 Indigenous and non-Indigenous students' preferences for cooperative learning situations in mathematics

Items about preferences for cooperative learning situations in mathematics	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
In mathematics I enjoy working with other students in groups	83	84	84	84
When we work on a project in mathematics, I think that it is a good idea to combine the ideas of all the students in a group	78	76	78	74
I do my best work in mathematics when I work with other students	**60**	**70**	68	72
In mathematics, I enjoy helping others to work well in a group	72	70	76	66
In mathematics I learn most when I work with other students in my class	63	63	**67**	**60**

The index of cooperative situations for learning mathematics was constructed using student responses to the above items, with higher values indicating a greater preference for cooperative learning situations in mathematics. The average scale scores of Indigenous students (0.13) and non-Indigenous students (0.10) on the cooperative learning situations index were not statistically different from one another, indicating that students had similar levels of preferences for cooperative learning situations in mathematics.

Male and female students also showed similar preferences for cooperative learning in mathematics classes. Although the mean for Indigenous females was 0.19 on the cooperative learning situations index and thus appeared higher than that of Indigenous males (0.08), it was not significantly different. There were no significant differences in the average scores of non-Indigenous male and females students.

Interestingly, the relationship between preference for cooperative learning situations in mathematics and mathematical literacy performance was negative; that is, students with stronger preferences for cooperative learning situations tended to achieve lower results in mathematical literacy performance. The correlation coefficients were similar for Indigenous and non-Indigenous students at -0.05 and -0.04, respectively.

Summary

This chapter has examined how Indigenous and non-Indigenous students manage their own learning process, the learning strategies they use, and their preferences for different learning situations. There were some differences in the type of strategy commonly employed by Indigenous and non-Indigenous students, with Indigenous students more commonly using basic strategies than non-Indigenous students.

No significant differences were found between Indigenous and non-Indigenous students on memorisation strategies in general study or when learning mathematics specifically. Females and males used memorisation strategies for learning to a similar extent.

There were no significant differences between Indigenous and non-Indigenous students' frequency of use of elaboration strategies in general study; however, Indigenous students used this learning strategy less often than their non-Indigenous peers in learning mathematics.

With respect to control strategies, which involve students regulating their own learning, there were no significant differences between Indigenous and non-Indigenous students in their use of control strategies when studying in general, but Indigenous students were less likely to use control strategies in mathematics. Female students were found to use control strategies to manage their learning significantly more often than male students.

Indigenous students were significantly less likely to prefer competitive learning situations in general settings than were non-Indigenous students, but there was no difference in the specific area of learning mathematics. There were also no significant gender differences for Indigenous students in their preferences for competitive learning situations, while among non-Indigenous students, males had a stronger preference for using competitive learning situations than females in both a general setting and in learning mathematics.

Indigenous and non-Indigenous students reported similar levels of preference for cooperative learning situations in both a general setting and in learning mathematics. Female students, regardless of Indigenous status, reported significantly stronger preferences for cooperative learning situations in general settings compared to males; however there were no significant differences specifically in learning mathematics.

The next chapter focuses on students' attitudes towards school and their broader engagement with school.

Chapter

5

The learning environment

Key findings

- Compared to non-Indigenous students, Indigenous students reported more frequent disruptions in mathematics classes
- Indigenous females reported stronger perceptions of teacher support in mathematics classes compared to Indigenous males.
- Indigenous males reported more disruption in their mathematics classes compared to Indigenous females.

School Climate

The school setting potentially plays an important role in influencing student attitudes, behaviour and performance. Results from PISA 2000 and PISA 2003 suggest that a supportive environment, which included a climate characterised by high expectations and positive teacher-student relations, can be a positive influence on students' performance, whereas disruptive behaviour and negative attitudes towards school may not only be associated with low academic performance, but may also factor in the decision to withdraw from school. The PISA student questionnaire asked students about their attitudes to school as well as their relationships with their teachers and peers.

Student's sense of belonging at school

PISA 2000 and 2003 included items designed to measure students' sense of belonging at their school, such as the following:

- I feel like an outsider (or left out of things),
- I make friends easily,
- I feel like I belong,
- I feel awkward and out of place,
- Other students seem to like me, and
- I feel lonely.

Students indicated the extent to which they agreed with these items on a four-point scale (strongly agree; agree; disagree; and strongly disagree).

Table 5.1 shows the percentage of Indigenous and non-Indigenous students who agreed or strongly agreed with the items about their sense of belonging at school. Responses to these items in PISA

2000 and 2003 suggest that Australian students have a strong sense of belonging at school. Indigenous and non-Indigenous students had similar responses to almost all of the items related to sense of belonging at school. The majority (at least 90%) of Australian students reported that other students liked them. Almost 90 per cent of Australian students agreed or strongly agreed that their school is a place where they feel they belong. Fewer than 15 per cent of Indigenous and non-Indigenous students reported they feel awkward and out of place, feel like an outsider or left out of things, and feel lonely at school.

Some significant differences were found in the responses to one of the items in PISA 2000 and two items in PISA 2003. Indigenous students reported making friends more easily than did non-Indigenous students; however, many more Indigenous than non-Indigenous students reported that they feel awkward and out of place.

Table 5.1 Indigenous and non-Indigenous students' sense of belonging at school, PISA 2000 and PISA 2003[11]

Items about sense of belonging at school	Percentage of students who agreed or strongly agreed			
	PISA 2000		PISA 2003	
	Indigenous	non-Indigenous	Indigenous	non-Indigenous
I feel like an outsider (or left out of things)[12]	8	9	14	8
I make friends easily	**94**	**90**	**94**	**91**
I feel like I belong	84	86	88	88
I feel awkward and out of place	13	11	**17**	**9**
Other students seem to like me	92	94	94	95
I feel lonely	6	8	12	6

Table 5.2 presents the proportions of Indigenous males and females who agreed or strongly agreed with the sense of belonging items. Overall, Indigenous students responded in a manner indicating a strong sense of belonging at their school, with no significant differences found between the responses for Indigenous females and males.

Table 5.2 Indigenous females and males' sense of belonging at school, PISA 2000 and PISA 2003

Items about sense of belonging at school	Percentage of students who agreed or strongly agreed			
	PISA 2000		PISA 2003	
	Females	Males	Females	Males
I feel like an outsider (or left out of things)	10	5	11	16
I make friends easily	95	94	92	95
I feel like I belong	84	84	89	88
I feel awkward and out of place	11	16	12	22
Other students seem to like me	95	89	94	94
I feel lonely	6	7	7	16

The six items listed above were used to construct an index of student's sense of belonging at school. High positive values on the index indicate a stronger sense of belonging at school. There were no statistically significant differences between the average scores of Indigenous and non-Indigenous students on the sense of belonging index either in 2000 or in 2003, and none were significantly different to the OECD average.

11 Throughout this chapter, values in bold indicate statistically significant differences between either non-Indigenous and Indigenous students or Indigenous females and males.

12 In PISA 2000 this question was asked as 'I feel left out of things' and in PISA 2003 this question was asked as 'I feel like an outsider (or left out of things)'.

On average, Indigenous females recorded similar scores to Indigenous males on the sense of belonging index, with no significant differences found in either PISA cycle. The average score on the 2000 index for Indigenous females was 0.08 while the average score for Indigenous males was 0.10. In PISA 2003, the mean scores on the sense of belonging at school index were 0.02 and -0.07 for Indigenous females and males, respectively.

In PISA 2000, non-Indigenous females (-0.05) and males (-0.06) recorded similar scores on average on the sense of belonging index. Results in 2003 were different though, with non-indigenous females recording a significantly stronger sense of belonging than their male peers, with mean scores of 0.09 for non-Indigenous females and 0.00 for non-Indigenous males.

A stronger sense of belonging at school was positively associated with reading literacy performance in PISA 2000, and with mathematical literacy performance in PISA 2003. The relationships were not strong, however. Among Indigenous students, a correlation of 0.11 for sense of belonging and reading literacy was found, while a correlation of 0.08 was found between sense of belonging and mathematical literacy for Indigenous students in 2003. Among non-Indigenous students, the correlation between sense of belonging and reading literacy was 0.04, and 0.03 for sense of belonging and mathematical literacy, respectively.

Student-teacher relations

Five items were used in PISA 2000 and PISA 2003 to measure the relationship students have with their teachers:

- Students get along well with most teachers,
- Most teachers are interested in students' well being,
- Most of my teachers really listen to what I have to say,
- If I need extra help, I will receive it from my teachers, and
- Most of my teachers treat me fairly.

Students were asked to indicate the extent of their agreement (on a four-point scale: strongly agree; agree; disagree; and strongly disagree).

Most Australian students from PISA 2000 and PISA 2003 indicated they have good relationships with their teachers (Table 5.3). Over 70 per cent of Australian students agreed or strongly agreed that most of their teachers really listen to what they have to say. Over three quarters of Australian students agreed or strongly agreed that most teachers are interested in their well being. More than 80 per cent of Australian students agreed or strongly agreed that they receive extra help from their teachers if they need it and that most of their teachers treat them fairly. Over 60 per cent of Australian students agreed or strongly agreed that students get along well with most teachers.

In PISA 2000, there were significantly fewer Indigenous students (62%) compared to non-Indigenous students (70%) who agreed or strongly agreed that students get along well with most teachers. In PISA 2003, there was no significant difference in the proportions of Indigenous and non-Indigenous students who agreed or strongly agreed with this item.

Table 5.3 Indigenous and non-Indigenous students' report of student-teacher relations, PISA 2000 and PISA 2003

Items about student-teacher relations	Percentage of students who agreed or strongly agreed			
	PISA 2000		PISA 2003	
	Indigenous	non-Indigenous	Indigenous	non-Indigenous
Students get along well with most teachers	**62**	**70**	76	78
Most teachers are interested in students' well being	77	79	82	82
Most of my teachers really listen to what I have to say	70	72	66	72
If I need extra help, I will receive it from my teachers	81	84	84	87
Most of my teachers treat me fairly	80	83	82	86

Table 5.4 presents the percentage of Indigenous male and female students who agreed or strongly agreed with the items about student-teacher relations. Overall, Indigenous females and males reported similar levels of agreement with the items about student-teacher relationships at school. The single exception was in 2003, when a significantly greater proportion of Indigenous females (88%) compared to Indigenous males (76%) agreed or strongly agreed that most of their teachers treat them fairly.

Table 5.4 Indigenous females and males' report of student-teacher relations, PISA 2000 and PISA 2003

Items about student-teacher relations	Percentage of students who agreed or strongly agreed			
	PISA 2000		PISA 2003	
	Females	Males	Females	Males
Students get along well with most teachers	67	56	76	76
Most teachers are interested in students' well being	76	77	85	78
Most of my teachers really listen to what I have to say	69	71	68	64
If I need extra help, I will receive it from my teachers	80	82	84	84
Most of my teachers treat me fairly	84	77	**88**	**76**

The student-teacher relations index was constructed using the five items above, with higher positive values indicating stronger relationships between student and teacher. In both PISA 2000 and PISA 2003, there were no significant differences in the mean scores of Indigenous and non-Indigenous students on the student-teacher relations index. In PISA 2000, the mean score on the index for Indigenous students was 0.08, while the mean score for non-Indigenous students was 0.17. In 2003, the mean scores on the student-teacher relations index for Indigenous and non-Indigenous students were -0.03 and 0.04, respectively.

On average, Indigenous females and males recorded similar mean scores on the student-teacher relations index in both PISA cycles. In 2000, the mean score for Indigenous females was 0.15 while the mean score for Indigenous males was 0.00. In 2003, Indigenous females and males scored 0.02 and -0.07, on average, respectively.

In contrast, there were significant gender differences in the average student-teacher relations scores of non-Indigenous students in both PISA cycles. Non-Indigenous females reported a higher mean score, indicating they perceived they had better relationships with their teachers compared to non-Indigenous males. In PISA 2000, non-Indigenous females recorded a mean score of 0.21 compared to a mean score of 0.14 for non-Indigenous males, and in PISA 2003 mean scores on the sense of belonging index were 0.09 and 0.00 for females and males, respectively.

Among Indigenous students, the correlation between student-teacher relations and reading literacy performance in PISA 2000 was 0.09, indicating a positive, albeit weak, relationship between relationships with teachers and reading performance. In 2003, there was no relationship found between student-teacher relations and mathematical literacy performance for Indigenous students ($r = 0.00$). Among non-Indigenous students, the associations between student-teacher relations and student performance were more moderate, with correlations of 0.17 in PISA 2000 for reading literacy performance and 0.19 in PISA 2003 for mathematical literacy performance.

The correlations for Indigenous and non-Indigenous students between student-teacher relations and mathematical literacy performance were significantly different to each other, and on further investigation, student-teacher relations was the only construct related to school and classroom climate to be significantly different between Indigenous and non-Indigenous students. Figure 5.1 shows the positive association between student-teacher relations and mathematical literacy performance. The score point difference for students in the highest and lowest quartiles of the student-teacher relations index was 13 score points on average for Indigenous students and 43 score points on average for non-Indigenous students.

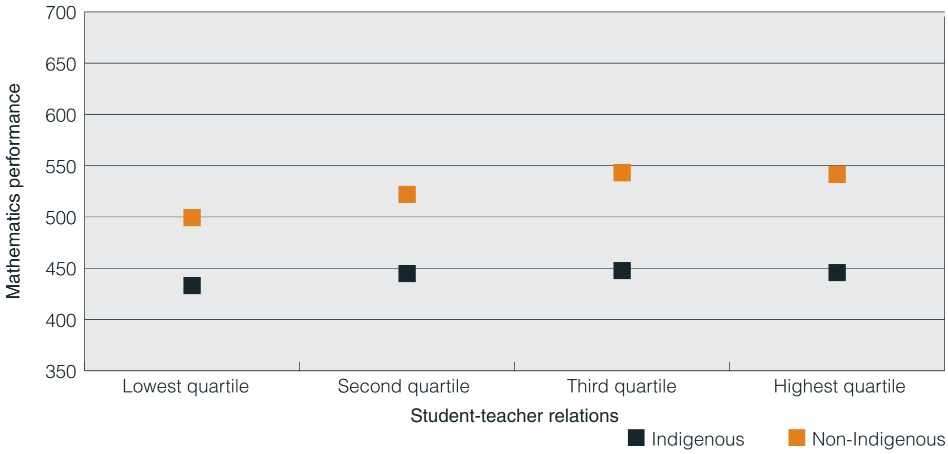

Figure 5.1 Mean mathematical literacy performance scores by quartiles on the student-teacher relations index, Indigenous and non-Indigenous students

Attitudes towards school

PISA 2003 collected information about students' attitudes towards school by asking them to indicate the extent of their agreement (on a four-point scale: strongly agree; agree; disagree; and strongly disagree) with the following four items:

- School has done little to prepare me for adult life when I leave school,
- School has been a waste of time,
- School has helped give me confidence to make decisions, and
- School has taught me things which could be useful in a job.

Australian students were quite positive in their attitudes to school, with over 90 per cent of students indicating that school had taught them things which could be useful in a job. Approximately 85 per cent of Australian students thought school helped give them confidence to make decisions (Table 5.5). There was, however, nine per cent of Indigenous students and six per cent of non-Indigenous students who agreed that school had been a waste of time. A significantly higher proportion of Indigenous students (34%) compared to non-Indigenous students (22%) agreed or strongly agreed that school had done little to prepare them for adult life when they leave school.

The responses presented in Table 5.5 show that most Indigenous females and males have similar and positive views about school. However, forty per cent of Indigenous males agreed or strongly agreed that school had done little to prepare them for adult life when they leave school compared to almost 30 per cent of Indigenous females. The proportion of Indigenous males (14%) who agreed that school had been a waste of time was almost three times the proportion of Indigenous females (5%) who endorsed this statement.

Table 5.5 Indigenous and non-Indigenous students' attitudes towards school

Items about attitudes towards school	Percentage of students who agreed or strongly agreed			
	non-Indigenous	Indigenous		
		All	Females	Males
School has done little to prepare me for adult life when I leave school	**22**	**34**	27	40
School has been a waste of time	6	9	**5**	**14**
School has helped give me confidence to make decisions	84	86	87	86
School has taught me things which could be useful in a job	92	92	93	90

Using the four items listed above, an index summarising students' attitudes to school was constructed. The mean scores of Indigenous students (0.21) and non-Indigenous students (0.25) were both significantly higher than the OECD average, but were not statistically different from one another. There was a tendency for females to be more positive in their attitudes towards school than their male peers. Among Indigenous students, the mean scores for females (0.26) and males (0.17) were not statistically different, while among non-Indigenous students, there was a statistically significant difference between the mean scores of females (0.31) and males (0.20).

Although there was a positive association between attitudes towards school and student performance, with more positive attitudes being associated with better mathematical literacy performance, the relationship was relatively weak. The correlation between attitudes to school index scores and mathematical literacy scores was 0.17 among Indigenous students and 0.16 among non-Indigenous students.

Classroom Climate

The classroom setting is another potential environmental influence that may help in understanding differences in student performance. Data collected in PISA 2000 and 2003 can be used to examine the influence of supportive teacher practices and the disciplinary climate of classrooms on student performance.

Teacher support

A supportive environment is one where the student benefits from teaching practices that demonstrate teachers' interest in the progress of their students, shows a willingness to help all students, and expects students to attain reasonable performance standards.

In PISA 2000, teacher support was assessed in relation to English lessons using the following items:

- The teacher shows an interest in every student's learning,
- The teacher gives students an opportunity to express opinions,
- The teacher continues teaching until the students understand,
- The teacher helps students with their learning,
- The teacher helps students with their work, and
- The teacher does a lot to help students.

Students were asked to indicate how often various supportive behaviours were exhibited by their teacher on a four-point scale (every lesson; most lessons; some lessons; and never or hardly ever).

The views of Indigenous and non-Indigenous students regarding their teachers' support in English lessons were positive and very similar (Table 5.6), with no statistically significant difference in the proportions of students who agreed with each of the items. There were no significant differences found in the proportions of Indigenous females and males who agreed with each of the statements about teacher support during English lessons.

Table 5.6 Indigenous and non-Indigenous students' report of teacher support in English lessons, PISA 2000

Items about teacher support	Percentage of students who reported this occurring in every or most lessons			
	non-Indigenous	Indigenous		
		All	Females	Males
The teacher shows an interest in every student's learning	73	73	77	69
The teacher gives students an opportunity to express opinions	78	74	**76**	**73**
The teacher continues teaching until the students understand	73	66	66	66
The teacher helps students with their learning	78	78	77	79
The teacher helps students with their work	81	81	82	80
The teacher does a lot to help students	71	72	70	74

Teacher support was also examined in PISA 2003, with some adjustments made to the items. In addition to shifting the focus from English lessons to mathematics lessons, a new item about additional help for students when required was presented along with four of the items used PISA 2000. The items used in PISA 2003 were:

- The teacher shows an interest in every student's learning,
- The teacher helps students with their learning,
- The teacher continues teaching until the students understand,
- The teacher gives students an opportunity to express opinions, and
- The teacher gives extra help when students need it.

Student responses were reported on a four-point scale: every lesson; most lessons; some lessons and never.

Most students reported supportive behaviours from their teachers in most lessons (Table 5.7). There were no significant differences found in the responses of Indigenous and non-Indigenous students to the items about teacher support during mathematics lessons.

Similar proportions of Indigenous females and males reported that their teacher showed an interest in all students' learning, continued teaching until students understand and gave students an opportunity to express opinions, with between 66 per cent and 74 per cent of Indigenous females and males reporting these supportive teacher behaviours occurring in most or every lesson. The proportion of Indigenous females who reported that their teacher provided extra help when needed (81%) or helped students with their learning (86%) in every or most lessons was significantly greater than the corresponding proportion of Indigenous males who endorsed these items (70% and 75%, respectively).

Table 5.7 Indigenous and non-Indigenous students' report of teacher support in mathematics classes, PISA 2003

Items about teacher support	Percentage of students who reported this occurring in every or most lessons			
	non-Indigenous	Indigenous		
		All	Females	Males
The teacher shows an interest in every student's learning	64	68	66	70
The teacher gives extra help when students need it	78	75	**81**	**70**
The teacher helps students with their learning	85	80	**86**	**75**
The teacher continues teaching until the students understand	72	71	74	68
The teacher gives students an opportunity to express opinions	63	66	66	66

For each of the PISA cycles, the index of teacher support was constructed using student responses to the relevant items – in 2000, the six statements shown in Table 5.6 were used and in 2003, the five statements in Table 5.7 were used.

Figure 5.2 shows the mean scores for Indigenous and non-Indigenous students on the teacher support index for PISA 2000 and PISA 2003, as well as the mean scores for Indigenous females and males. Both Indigenous and non-Indigenous students indicated that their teachers were very supportive during English lessons, with average scores of 0.37 and 0.42, respectively. This was also the case for mathematics lessons, with a mean score of 0.23 for Indigenous students and 0.25 for non-Indigenous students. There were no significant differences in the average scores Indigenous and non-Indigenous students on the indices for PISA 2000 or PISA 2003.

There were no significant differences in the level of support perceived by Indigenous females and Indigenous males in English lessons, with mean scores of 0.44 and 0.29, respectively, on the index. However, Indigenous females perceived their teachers to be more supportive in their mathematics lessons with a mean score of 0.35, which was significantly higher than that of Indigenous males, at 0.12.

Significant gender differences were also found among non-Indigenous students. Females perceived their teachers to be more supportive than did males, with mean scores of 0.48 and 0.35, respectively, in English lessons, and mean scores of 0.29 and 0.21, respectively, in mathematics lessons.

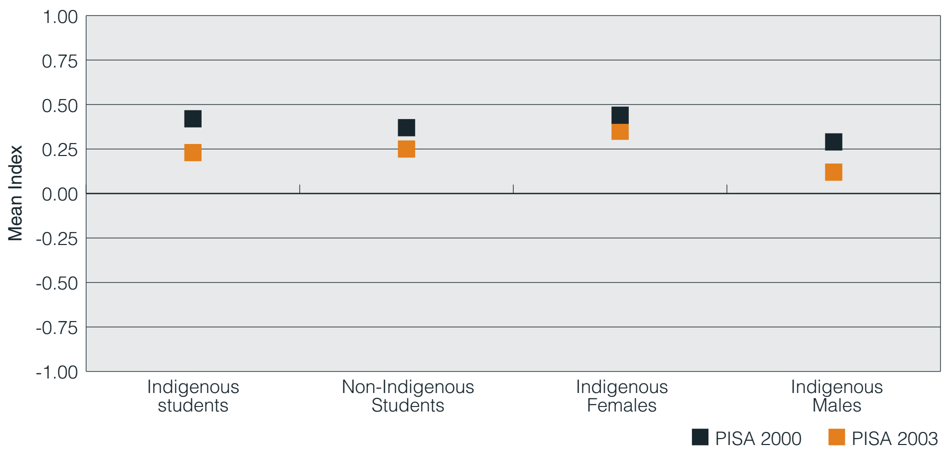

Figure 5.2 Teacher support for Indigenous and non-Indigenous students, and Indigenous females and males

The relationship between teacher support and student performance was very weakly positive. In PISA 2000, the correlation between teacher support and reading literacy performance for Indigenous students was 0.09, and for non-Indigenous students the correlation was 0.07. In PISA 2003, the correlations between teacher support and mathematical literacy performance for Indigenous and non-Indigenous students were 0.08 and 0.12, respectively.

Disciplinary climate

The PISA 2000 and 2003 questionnaires collected information about students' perceptions about the disciplinary climate in their classes. In PISA 2000, students were asked to indicate (on a four-point scale: every lesson; most lessons; some lessons and never) how often the following things happen in their English lessons:

- Students don't listen to what the teacher says,
- There is noise and disorder,
- The teacher has to wait a long time for students to quieten down,
- Students cannot work well,
- Students don't start working for a long time after the lesson begins, and
- At the start of the class, more than five minutes are spent doing nothing.

In PISA 2000, a substantial proportion of students reported that classes were slow to start, with about 40 per cent of Australian students indicating that more than five minutes are spent doing nothing at the start of the class, and about 30 per cent of students reporting waiting for a long time for students to quieten down and that there is noise and disorder in every or most lessons. Significantly greater proportions of Indigenous students compared to non-Indigenous students thought students cannot work well (24% compared to 18%) and that students don't begin working for a long time after the lesson begins (32% compared to 26%). Indigenous females and males reported similar views of the disciplinary climate in English lessons (Table 5.8).

Table 5.8 Indigenous and non-Indigenous students' report of English classroom disciplinary climate, PISA 2000

Items about disciplinary climate	Percentage of students who report behaviours that occur every lesson or most lessons			
	non-Indigenous	Indigenous		
		All	Females	Males
Students don't listen to what the teacher says	21	25	23	28
There is noise and disorder	32	37	32	42
The teacher has to wait a long time for students to quieten down	31	32	27	38
Students cannot work well	**18**	**24**	20	29
Students don't start working for a long time after the lesson begins	**26**	**32**	28	37
At the start of the class, more than five minutes are spent doing nothing	42	43	43	42

In PISA 2003, students were also asked about the disciplinary climate of their classes. Five of the six statements asked in PISA 2000 were also asked in PISA 2003, but with a focus on the climate of mathematics classes. Students were asked to indicate on a four-point scale (every lesson; most lessons; some lessons; and never or hardly ever) how often the following examples of disruptive behaviour occurred in their mathematics classes:

- Students don't listen to what the teacher says,
- There is noise and disorder,
- The teacher has to wait a long time for students to quieten down,
- Students cannot work well, and
- Students don't start working for a long time after the lesson begins.

Table 5.9 shows the percentages of Indigenous and non-Indigenous students from PISA 2003 who reported disruptive behaviours occurring in their mathematics classes in most or every lesson. Overall, between one-third and half of the students reported that these disruptive behaviours occur in the majority of mathematics lessons. Indigenous students reported disruptive behaviours occurring more frequently compared to non-Indigenous students, with significant differences found on every item related to discipline in the mathematics classroom.

Significantly more Indigenous females (57%) reported noise and disorder occurring frequently in their mathematics lessons compared to Indigenous males (46%). Significantly more Indigenous males, compared to Indigenous females, reported that students not working well and students not starting work for a long time after the lesson begins was an occurrence in most or every mathematics lesson. There were no significant differences in the proportions of Indigenous females and males who indicated that students not listening to the teacher or the teacher, having to wait a long time for students to quieten down, happened in most or all of their lessons.

Table 5.9 Indigenous and non-Indigenous students' report of mathematics classroom disciplinary climate, PISA 2003

Items about disciplinary climate	Percentage of students who report behaviours that occur every lesson or most lessons			
	non-Indigenous	Indigenous		
		All	Females	Males
Students don't listen to what the teacher says	**33**	**42**	39	45
There is noise and disorder	**42**	**51**	**57**	**46**
The teacher has to wait a long time for students to quieten down	**32**	**43**	41	44
Students cannot work well	**20**	**31**	**26**	**35**
Students don't start working for a long time after the lesson begins	**26**	**40**	**35**	**44**

Indices of the disciplinary climate of English and mathematics classrooms were created from the six English items shown in Table 5.8 and the five mathematics items listed in Table 5.9. Low values on these indices indicate a poorer disciplinary climate in which disruptive behaviours occur more frequently.

In PISA 2000, there was no significant difference in the mean scores of Indigenous students (-0.17) and non-Indigenous students (-0.09) on the disciplinary climate index for English classes: both were lower than the OECD mean. Female and male Indigenous students held similar views of the disciplinary climate of their English classes, with mean scores of -0.09 and -0.25, respectively, on the index. In contrast, non-Indigenous males (-0.13) perceived their English classes to be more disrupted than their female peers did, scoring significantly lower on the disciplinary climate index compared to non-Indigenous males (-0.05).

In PISA 2003, Indigenous students reported significantly more frequent disruptions in their mathematics classes than did non-Indigenous students. Indigenous students recorded lower scores on average on the index for disciplinary climate in mathematics classes than their non-Indigenous counterparts, with means of -0.27 and -0.01, respectively. There was no significant difference in the average scores of Indigenous females (-0.21) and males (-0.33) on this index. Non-Indigenous males perceived the disciplinary climate to be more disruptive than did non-Indigenous males, with means of 0.04 and -0.05, respectively. The means on the disciplinary climate index are shown in Figure 5.3.

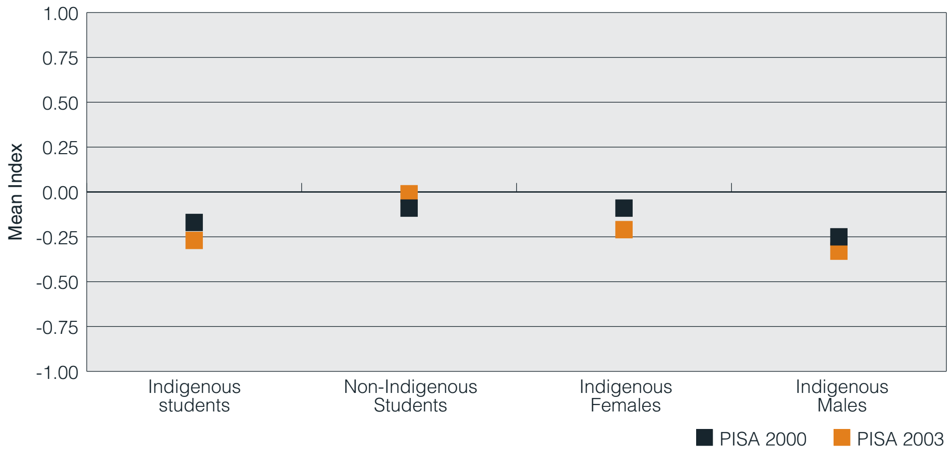

Figure 5.3 Disciplinary climate for Indigenous and non-Indigenous students, and Indigenous females and males

The association between disciplinary climate and student performance was positive, that is, higher scores on the disciplinary climate index were found to be associated with higher student performance. The correlation between disciplinary climate and reading literacy performance for Indigenous students was 0.12, and for non-Indigenous students, a correlation of 0.16 was found. The relationship between disciplinary climate and mathematical literacy performance was slightly stronger at 0.23 for both Indigenous and non-Indigenous students.

Summary

This chapter examined Indigenous and non-Indigenous students' attitudes towards school, school climate and the learning environment in classrooms and at school.

Two of the constructs related to general engagement with schooling — sense of belonging at school and attitudes towards school — showed that Indigenous and non-Indigenous students did not differ significantly in terms of their sense of belonging at school and attitudes towards school. There were no significant gender differences in the average index scores of Indigenous students, while non-Indigenous females in PISA 2003 reported a significantly stronger sense of belonging at school, and significantly more positive attitudes towards schools than non-Indigenous males.

Indigenous and non-Indigenous students had similar views about the relationships students have with their teachers. No significant differences were found between Indigenous females and males on student-teacher relations, while in PISA 2003, non-Indigenous females reported better relationships with teachers than their male counterparts.

Indigenous and non-Indigenous students held similar views about the level of support their teachers displayed in English and mathematics classes. There were no significant differences reported between Indigenous and non-Indigenous students on teacher support. Male and female indigenous students recorded similar levels of teacher support in the English classroom, but differed in their views of support in the mathematics classroom, with Indigenous females reporting greater support than their male peers. Non-Indigenous females reported higher levels of teacher support than non-Indigenous males in both their English and mathematics lessons.

Indigenous and non-Indigenous students perceived the disciplinary climate of their English classes similarly and there were no significant differences in their average index scores. However, Indigenous students reported significantly more disciplinary problems in their mathematics lessons compared to non-Indigenous students. Indigenous males and females did not differ in their views of the disciplinary climate of their English or mathematics classes. Among non-Indigenous students, however, males reported significantly more disruptions in both English and mathematics than females.

The next chapter presents results of multivariate analyses of student performance in PISA, which include those factors found in the previous chapters to have statistically significant relationships with performance.

Chapter 6

Influences on Indigenous students' performance in PISA: Putting it all together

Key findings

- Home educational resources, engagement in reading and academic self-concept were found to significantly influence reading performance.
- Disciplinary climate, absence during primary school, elaboration strategies, socioeconomic status, self-efficacy in mathematics, self-concept in mathematics, gender and preschool attendance were found to significantly influence mathematics performance.
- Socioeconomic status, home educational resources, self-efficacy in science and general value of science were found to significantly influence science performance.

Through the exploration in previous chapters of the relationships between performance and the factors that previous research has found to affect performance, a picture has emerged of areas of significant difference between Indigenous and non-Indigenous students.

To further explore these relationships in the PISA assessments, multivariate regression analyses were conducted for each literacy domain. Factors that have shown a significant relationship with Indigenous students' performance in the earlier univariate analyses were included in the subsequent multivariate analyses, and factors that were found not to be statistically significant contributors were removed from the final model.

Factors that influence Indigenous students' reading performance

There were three factors that were found to significantly influence students' reading performance: home educational resources, engagement in reading and academic self-concept. The regression model that included these factors explained 23 per cent of the variance in Indigenous students' reading literacy performance in PISA 2000. On average, Indigenous students scored 29 score points higher on the reading literacy scale per unit increase in the *engagement in reading* index, 24 score points higher on the reading literacy scale per unit increase in the *home educational resources* index and 17 score points higher on the reading literacy scale per unit increase in the *academic self-concept* index[13].

13 Please refer to Appendix B for the unstandardised regression coefficients in this chapter.

This model underscores the importance of motivational factors in reading achievement. While the level of home educational resources (including the number of books in the home) is clearly important for student achievement, engagement in reading has a stronger effect. The effect of academic self-concept is also important. These findings are important, as student beliefs are to some extent amenable by schools, and it should be possible to compensate for a lack of home educational resources by increasing resources available at the school level.

Factors that influence Indigenous students' mathematics performance

Eight factors were found to significantly influence mathematics performance. Four of these factors were indices (created from student's responses to multiple questions), three of the factors (gender, preschool attendance and absences from primary school) were based on categorical data and one of the factors, socioeconomic background, was measured using the quartiles (rather than the index scores)[14]. Together, these factors were found to explain 30 per cent of the variance in Indigenous students' mathematical literacy performance in PISA 2003.

The model shows that self-efficacy in mathematics, and to a lesser extent, self-concept in mathematics are important constructs in influencing mathematical literacy performance, as Indigenous students who believe in their academic ability and who can confidently complete mathematics tasks are more likely to perform at a higher level on the mathematical literacy scale. On average, every one unit increase in the self-efficacy scale or the self-concept scale was associated with an increase in Indigenous students' mathematical literacy score by 31 and 20 score points, respectively.

Indigenous students who attended pre-school performed at a higher level on the mathematical literacy scale. For each increase in category in pre-school attendance, students scored on average, 22 points higher on the mathematical literacy scale. If further investigations were to be carried out, it is quite likely that this factor is measuring more than students' attendance at pre-school, and also partially reflects the values a family holds about education. Families that value education highly and view education as providing greater opportunities, may be more likely to enrol their children in pre-school. In this way, the variable included in the analysis may also be filtering the influence of family values about education on students' performance in the mathematical literacy assessments.

Two of the background variables collected by PISA were also found to significantly influence Indigenous students' mathematics performance. Indigenous females performed on average, 16 score points higher on the mathematical literacy scale, all other variables held constant. Family background, in socioeconomic terms, was also a significant influence, with each increase in socioeconomic status quartile (for example, from the lowest quartile to the lower middle or from the higher middle to the highest quartile), being associated with a seven point increase in the mathematical literacy score.

While the factors related to the school and classroom climates were not found to be significant influences in the reading literacy (above) or scientific literacy (presented below) models, the measure of classroom disciplinary climate was found to be a significant and positive influence on Indigenous students' mathematics performance in PISA 2003. On average, Indigenous students scored 10 score points higher on the mathematical literacy scale per unit increase in the disciplinary climate index.

Two factors included in the final model had a negative influence on mathematics performance. As would be expected, Indigenous students who were absent from school for long periods of time did not perform as well in mathematics compared to students who had spent more time on task.

---

14 The quartiles of the HISEI index were used instead of the index scores as this construct can be interpreted in the results of the analyses in a more meaningful way than the actual scores.

On average, Indigenous students scored 21 score points lower on the mathematical literacy scale per unit increase in the factor relating to absences during primary school (for example, moving from not ever having missed an extended period of primary school, to having missed one extended period of primary school).

The other factor to be associated with lower mathematics performance for Indigenous students was their reported use of elaboration strategies in learning mathematics. Elaboration strategies involve students integrating new information to their existing knowledge. It would be expected that this learning strategy would improve mathematics performance, however, on average, Indigenous students scored 24 score points lower on the mathematical literacy scale per unit increase in the elaboration strategies index. Further investigations are necessary to help disentangle how elaboration strategies are influencing mathematics performance for Indigenous students and why what might have been expected to be a positive influence on mathematics performance appears to be acting negatively among this group of students.

Factors that influence Indigenous students' science performance

In the final model examining influences on Indigenous students' scientific literacy scores, four of the significant contributors were indices, and one was a categorical variable based on quartiles of the HISEI index (the measure of socioeconomic background).

Two of the influential factors related to students' home backgrounds: socioeconomic background and home educational resources; and two of the factors were related to their own beliefs: self-efficacy in science and general value of science. Altogether, these factors were found to explain 28 per cent of the variance in Indigenous students' scientific literacy performance in PISA 2006. The results from this model indicate that general value of science and self-efficacy in science play an important role in influencing scientific literacy performance. On average, Indigenous students scored 25 score points higher on the scientific literacy scale per unit increase in the general value of science index, and 20 score points higher on the scientific literacy scale per unit increase in the self-efficacy in science index.

It is interesting to note that personal value of science and enjoyment of science were also found to significantly influence scientific literacy performance; however, further investigation found evidence of multicollinearity (i.e., these factors were found to be highly correlated) and therefore these predictor factors were removed from the model. This is not to say that the relationships between these constructs and Indigenous students' scientific literacy are trivial, only that the techniques used in the current analyses were limited in their capacity to cope with the complex relationships between the constructs, and thus their individual contributions to student performance on the scientific literacy assessments. Further investigation of the influence of personal enjoyment and engagement with science on students' performance in this area is warranted in the search for ways to improve student's learning.

In terms of home background, home educational resources and, to a lesser extent, socioeconomic status also played an important influence in Indigenous students' scientific literacy performance. On average, Indigenous students scored 23 score points higher on the scientific literacy scale per unit increase in the home educational resources index. For each increase in socioeconomic status quartile, Indigenous students scored on average, 10 points higher on the scientific literacy scale.

The model shows that Indigenous students who come from homes with a higher socioeconomic background, who have more educational resources in the home, who believe they can confidently perform various science tasks, and who value the contribution of science and technology for the improvement of society, will perform at a significantly higher level on science compared to those Indigenous students who do not have similar backgrounds or similar attitudes towards science and their own capacity in science.

Chapter 7

Summary and conclusions

This report has used the data available from all three cycles of PISA to examine various aspects of Indigenous students' background and psychological constructs and their relationship to each other and to student performance.

In Chapter 2 the focus was on home and educational resources in the home. Relationships found in PISA and for other similar programs show that level of parental education and level of educational resources in the home are positively related to student achievement. On both counts, Indigenous students were found to be at a disadvantage, on average, compared to non-Indigenous students. Fewer parents of Indigenous students compared to non-Indigenous students had attended post-secondary education and many parents of Indigenous students had not completed secondary school. This in itself creates a barrier to further education – without an understanding of the educational system it is difficult for parents to provide adequate levels of support for students to continue their education.

Indigenous students were also found to be more likely to live in single parent families than non-Indigenous students, and were less likely to possess items of family wealth than non-Indigenous students. The effects of inadequate resourcing mean that in such circumstances students are less likely to have access to the required books and materials, or to have a quiet place to study. In terms of access to indicators of family wealth (possessions) and educational resources, Indigenous students, on average, had slightly lower levels of access, with fewer students indicating that they had a computer, Internet connection, or a desk or textbooks for study compared to their non-Indigenous peers.

While overall, students from more advantaged socioeconomic backgrounds performed at a higher level than those from disadvantaged backgrounds, results presented in Chapter 2 showed that the influence of socioeconomic background on performance was not as strong among Indigenous students as it was among non-Indigenous students. However, even at the lower levels of socioeconomic background, Indigenous students had greater levels of disadvantage than did non-Indigenous students.

Also examined were students' responses to questions about attendance at pre-school and interruptions to schooling throughout their primary and secondary education. While the majority of Indigenous students reported attending pre-school, more Indigenous than non-Indigenous students reported spending just one year at pre-school. In terms of interruptions or irregularities in school exposure, a greater proportion of Indigenous students reported arriving late for school on a regular basis, and prolonged absences from school occurred more frequently for Indigenous students than non-Indigenous students.

For the most part, these factors are outside the realm of influence of schools, however, the influence of such factors as educational resources and interruptions to attendance are open to intervention by school systems. If educational resources are not available at the home, then every attempt should be made to compensate for this at the school. The importance of regular and uninterrupted attendance at all points in the educational career of students can be communicated from the very beginning of contact with services, in pre-school and pre-school programs, which should also be strongly encouraged for all students.

Chapter 3 investigated students' attitudes, engagement, motivation and beliefs, and their relationships with performance. Indigenous students were found to be at a disadvantage in a number of these areas, all of which are able to be targeted for intervention by schools, quality educators and other professionals.

Indigenous students were significantly less interested and less engaged in reading than their non-Indigenous peers. Indigenous males, in particular, reported low average levels of interest and engagement in reading. The importance of individual interest in the development and continuation of learning has been well-researched and recommendations for how to intervene early on in the education of boys, in particular, so as to increase the likelihood of enjoyment and interest in reading abound.

Indigenous students' appreciation of science, both from a general or personal perspective, were significantly lower than that reported by non-Indigenous students. Indigenous students were also found to have significantly lower levels of instrumental motivation in science than non-Indigenous students.

On average, Indigenous students reported significantly lower levels of confidence in their abilities to handle tasks effectively than their non-Indigenous peers. These differences were found when self-efficacy was assessed generally, as well as when self-efficacy was assessed in relation to mathematics and science.

In terms of self-concept, there were no significant differences between Indigenous and non-Indigenous students on academic self-concept and self-concept in reading. However, the levels of self-concept in mathematics and science for Indigenous students were significantly lower than for non-Indigenous students.

Despite their lower levels of self confidence and self-concept, particularly in relation to mathematics and science, there were no differences found in the levels of effort and persistence in studying reported by Indigenous and non-Indigenous students.

Self-efficacy in mathematics and science were found to have one of the strongest associations with student performance among Indigenous and non-Indigenous students alike. Self-concept was also positively related to student performance, more so in mathematics and science than in reading.

Schools may need to revisit how to make the science curriculum more related to students' own experiences in order to foster more positive attitudes towards this subject area, and thereby improve student knowledge and understanding of science. At the same time, developing positive self-concept and perceptions of self-efficacy for Indigenous students should also be a priority.

Chapter 4 presented information about students' learning strategies and preferences and Chapter 5 examined aspects of the learning environment that might be expected to be related to student performance. There were no great differences between Indigenous and non-Indigenous students' use of different learning strategies, such as memorisation, elaboration or control techniques overall, although there were some differences noted in the propensity of Indigenous students to use certain control strategies, such as checking what they had already learned and what they still needed to learn. In general, Indigenous students reported lower preferences for competitive learning environments than did their non-Indigenous peers.

In terms of the learning environment, no significant differences were found in the attitudes towards school or sense of belonging to school of Indigenous and non-Indigenous students, an extremely positive finding that indicates that schools are doing well at providing a supportive and welcoming environment for all students. Nor were any differences found in the ways students reported interacting with their teachers, or in the disciplinary climate of their classes.

The multivariate analyses presented in Chapter 6 confirmed the importance of the influences discussed above, although there are some relationships that warrant further investigation.

There are a number of important findings from the analyses described in this report. These can be categorised in terms of affective behaviours that influence achievement, and student background factors that influence achievement.

In terms of affective behaviours, the analyses have shown that students who approach learning with confidence, have belief in their abilities, are interested in learning, are motivated, are not anxious about their learning, and who use a range of learning strategies are more likely to be successful learners and to perform well in the assessments. It is likely that they will also be better able to manage and regulate their learning long after they leave formal education, and that these attributes will ensure that they are equipped to be active citizens. Of great importance for the nation's capacity for redressing the educational inequalities that exist for our Indigenous students will be the challenge to provide educational environments that foster and encourage these self beliefs, allowing students to develop confidence in their own abilities and take control over their learning in the present and into the future.

The other main findings reflect student background factors. The analyses presented in this report show that there are still large gaps in the socioeconomic background of Indigenous and non-Indigenous students. Lower levels of attendance at pre-school, less access to home educational resources, and parents with lower levels of experience of education contribute to many Indigenous children starting school at a disadvantage and then these problems compound as throughout their school lives Indigenous students are more likely to be late to school on a regular basis, to miss consecutive months of schooling, and to change school several times. In national tests in the early years of primary schooling, Indigenous students consistently achieve at lower levels than their non-Indigenous peers, and as schooling continues, the gaps that are there at the beginning of primary school gradually widen as poor attendance compounds a poor start to school. Lower achievement and discontinuity of schooling can lead to lower levels of self-confidence and self-efficacy, which in turn further hinder academic achievement. One of the aims of education is to provide students with opportunities in their lives, and it is important that students and their parents understand the impact of their choices in terms of limiting these opportunity. School systems can and should have a role in furthering this understanding, not just putting punitive measures into place to combat truancy.

Appendix

A

Summary of Indices

These tables provide the index means and standard errors used to construct the figures of indices in this report.

Table A.1 Mean index and standard errors for home and educational background indices

Index	Indigenous students						Non- Indigenous students					
PISA Cycle	2000		2003		2006		2000		2003		2006	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.
Family wealth	-0.26	0.08	N/A	N/A	-0.03	0.04	0.44	0.02	N/A	N/A	0.41	0.01
Home educational resources	-0.63	0.09	-0.32	0.10	-0.53	0.08	0.07	0.02	0.11	0.09	0.06	0.01

Table A.2 Mean index and standard errors for attitudes, engagement, motivation and belief indices

Index	Indigenous students		Non- Indigenous students		Indigenous females		Indigenous males	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.
Interest in reading	-0.18	0.05	-0.02	0.02	0.04	0.05	-0.40	0.09
Engagement in reading	-0.22	0.05	-0.07	0.03	0.02	0.07	-0.48	0.08
General interest in learning science	-0.43	0.05	-0.21	0.01	-0.44	0.07	-0.43	0.06
Enjoyment in science	-0.29	0.05	-0.07	0.02	-0.32	0.06	-0.26	0.07
General value of science	-0.41	0.05	-0.04	0.01	-0.40	0.05	-0.43	0.08
Personal value of science	-0.22	0.04	0.02	0.01	-0.17	0.06	-0.27	0.06
Instrumental motivation	-0.13	0.05	0.11	0.02	-0.10	0.07	-0.16	0.05
General self-efficacy	-0.04	0.06	0.09	0.02	-0.12	0.11	0.04	0.08
Self-efficacy in mathematics	-0.21	0.05	0.11	0.02	-0.35	0.05	-0.09	0.06
Self-efficacy in science	-0.35	0.05	0.13	0.01	-0.43	0.06	-0.27	0.08
Self-concept in mathematics	0.04	0.04	0.13	0.02	-0.08	0.05	0.14	0.05
Self-concept in science	-0.26	0.05	-0.03	0.01	-0.35	0.06	-0.18	0.06
Mathematics anxiety	0.18	0.06	-0.06	0.01	0.28	0.07	0.08	0.12

Table A.3 Mean index and standard errors for learning strategies and preference indices

Index	Indigenous students		Non- Indigenous students		Indigenous females		Indigenous males	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.
Elaboration strategies for learning mathematics	0.27	0.06	0.06	0.01	0.18	0.04	0.35	0.10
Control strategies for general learning	-0.06	0.06	0.02	0.02	0.03	0.10	-0.17	0.07
Preference for competitive learning situations	-0.04	0.05	0.10	0.02	-0.09	0.09	0.01	0.08
Preference for cooperative learning situations	0.06	0.04	0.03	0.01	0.18	0.06	-0.06	0.06

Table A.4 Mean index and standard errors for the learning environment indices

Index	Indigenous students		Non- Indigenous students		Indigenous females		Indigenous males	
	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.	Mean index	S.E.
Teacher support – PISA 2000	0.37	0.07	0.42	0.02	0.44	0.11	0.29	0.09
Teacher support – PISA 2003	0.23	0.06	0.25	0.02	0.35	0.05	0.12	0.08
Disciplinary climate – PISA 2000	-0.17	0.06	-0.09	0.03	-0.09	0.08	-0.25	0.09
Disciplinary climate – PISA 2003	-0.27	0.04	-0.01	0.02	-0.21	0.08	-0.33	0.06

Appendix

B

Summary of Correlations

These tables provide a summary of the correlation coefficients (along with the standard errors) that were described in this report. In addition, the strength of the relationship between a construct and student performance, as interpreted for the purposes of this report (and noted in the Reader's Guide) have also been included. The key is as follows:

Strength of association
strong negative association
moderate negative association
little (weak) or no association
moderate positive association
strong positive association

Table B.1 Correlations and standard errors of home and educational background indices with student performance

Index	Indigenous students		Non- Indigenous students	
	Correlation coefficient	S.E.	Correlation coefficient	S.E.
	Reading performance			
Parents' educational attainments	0.07	0.05	0.28	0.02
Family wealth	0.21	0.06	0.13	0.02
Home educational resources	0.37	0.06	0.21	0.02
	Mathematics performance			
Parents' educational attainments	0.06	0.04	0.23	0.02
Home educational resources	0.22	0.06	0.22	0.02
Pre-school attendance	0.20	0.04	0.10	0.01
Missing primary school	-0.16	0.06	-0.14	0.01
Missing lower-secondary school	-0.20	0.06	-0.16	0.01
	Science performance			
Parents' educational attainments	0.20	0.04	0.25	0.01
Family wealth	0.24	0.05	0.01	0.01
Home educational resources	0.39	0.04	0.17	0.01

Table B.2 Correlations and standard errors of attitudes, engagement, motivation and belief indices with student performance

Index	Indigenous students		Non- Indigenous students	
	Correlation coefficient	S.E.	Correlation coefficient	S.E.
	Reading performance			
Interest in reading	0.19	0.06	0.36	0.02
Engagement in reading	0.31	0.05	0.43	0.02
Instrumental motivation	0.05	0.07	0.07	0.02
Effort and persistence	0.10	0.05	0.17	0.02
Self-efficacy	0.19	0.06	0.23	0.02
General academic self-concept	0.24	0.05	0.33	0.02
Self-concept in English	0.02	0.07	0.12	0.02
Control expectations	0.17	0.06	0.23	0.02
Mathematics anxiety	-0.24	0.05	-0.35	0.01
	Mathematics performance			
Interest in and enjoyment in mathematics	0.06	0.05	0.19	0.01
Instrumental motivation in mathematics	0.09	0.05	0.18	0.01
Self-efficacy in mathematics	0.40	0.05	0.52	0.01
Self-concept in mathematics	0.23	0.06	0.41	0.01
	Science performance			
General interest in learning science	0.24	0.05	0.33	0.02
Enjoyment in science	0.31	0.05	0.44	0.01
General value of science	0.40	0.03	0.37	0.01
Personal value of science	0.21	0.05	0.36	0.01
Instrumental motivation in science	0.20	0.07	0.32	0.01
Self-efficacy in science	0.40	0.03	0.37	0.01
Self-concept in science	0.20	0.08	0.43	0.01

Table B.3 Correlations and standard errors of learning strategies and preference indices with student performance

Index	Indigenous students		Non- Indigenous students	
	Correlation coefficient	S.E.	Correlation coefficient	S.E.
	Reading performance			
Memorisation strategies for general learning	0.14	0.06	0.09	0.02
Elaboration strategies for general learning	0.15	0.07	0.13	0.02
Control strategies for general learning	0.21	0.07	0.25	0.02
Preference for competitive learning situations	0.12	0.07	0.19	0.02
Preference for cooperative learning situations	0.18	0.07	0.05	0.02
	Mathematics performance			
Memorisation strategies for learning mathematics	0.10	0.01	0.04	0.06
Elaboration strategies for learning mathematics	-0.08	0.06	-0.01	0.01
Control strategies for learning mathematics	0.13	0.06	0.15	0.01
Preference for competitive learning situations in mathematics	0.04	0.05	0.13	0.01
Preference for cooperative learning situations in mathematics	-0.05	0.05	-0.04	0.01

Table B.4 Correlations and standard errors of the learning environment indices with student performance

Index	Indigenous students		Non- Indigenous students	
	Correlation coefficient	S.E.	Correlation coefficient	S.E.
	Reading performance			
Student's sense of belonging at school	0.11	0.06	0.04	0.02
Teacher-student relations	0.09	0.07	0.17	0.02
Teacher support	0.09	0.06	0.07	0.02
Disciplinary climate	0.12	0.05	0.16	0.02
	Mathematics performance			
Student's sense of belonging at school	0.08	0.04	0.03	0.02
Teacher-student relations	0.00	0.09	0.19	0.01
Attitudes towards school	0.17	0.04	0.16	0.01
Teacher support	0.08	0.06	0.12	0.02
Disciplinary climate	0.23	0.04	0.23	0.01

Appendix

C

Summary of unstandardised regression coefficients from the multivariate regression analyses

Table C.1 Unstandardised regression coefficients for Indigenous students' reading literacy in PISA 2000

Constructs	Unstandardised coefficients	
	B	SE
Constant	480	6.0
Home educational resources	24	4.0
Engagement in reading	29	5.5
Academic self-concept	17	6.8

Table C.2 Unstandardised regression coefficients for Indigenous students' mathematical literacy in PISA 2003

Constructs	Unstandardised coefficients	
	B	SE
Constant	423	14.5
Disciplinary climate	10	2.5
Absence during primary school	-21	7.3
Elaboration strategies	-24	3.6
Socioeconomic status	7	2.2
Self-efficacy in mathematics	31	3.0
Self-concept in mathematics	20	3.3
Gender	15	4.5
Preschool attendance	22	4.6

Table C.3 Unstandardised regression coefficients for Indigenous students' scientific literacy in PISA 2006

Constructs	Unstandardised coefficients	
	B	SE
Constant	459	7.2
Socioeconomic status	10	3.8
Home educational resources	23	4.6
Self-efficacy in science	20	4.3
General value of science	25	5.2

References

Australian Bureau of Statistics (2007). *Population Distribution, Aboriginal and Torres Strait Islander Australians 2006*, ABS Catalogue 4705.0, Canberra.

Bandura, A. (1982). Self efficacy mechanism in human agency. *American Psychologist*, 27, 122 – 147.

Bandura, A. (1986). *Social foundations of thought and action: A social cognitive theory*. Englewood Cliffs, NJ: Prentice Hall.

Benton, P. (1995). Conflicting cultures on the reading and viewing of secondary school pupils. *Oxforrd Review of Education*, 21, 457-470.

Commonwealth of Australia. (2002). *National report on Indigenous education and training 2001.* Canberra: Commonwealth of Australia.

De Bortoli, L. & Thomson, S. (2009). *The achievement of Australia's Indigenous students in PISA 2000 – 2006.* Melbourne: Australian Council for Educational Research.

Hillman, K. & Thomson, S. (2006). *Pathways from PISA: The PISA Australian PISA sample two years on.* Paper presented at the ECER 2006 Annual Conference: Transforming knowledge. Geneva, 11-16 September.

Horton, D. (1996). *The effectiveness of preschool attendance on reading and mathematics achievement.* [Microfiche] (ERIC Document Reproduction Service No. ED 400829.)

Hunter, B., & Schwab, R.G. (2003). *Practical reconciliation and recent trends in Indigenous education.* Centre for Aboriginal Economic Policy Research Discussion Paper, 249. Canberra:ANU.

Martin, A.J., & Marsh, H. W. (2006). Academic resilience and its psychological and educational correlates: A construct validity approach. *Psychology in the Schools*, 43, 267 -282.

Martin, A.J. (2006). A motivational psychology for the education of Indigenous Australian students. *The Australian Journal of Indigenous Education*, 35, 30 - 43.

Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), (2008). *National Declaration on Educational Goals for Young Australians – Draft*. Carlton: Curriculum Corporation. (http://curriculum.edu.au/mceetya/melbourne_declaration,25979.html)

Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), (2007). *National Assessment Program – ICT Literacy Years 6 & 10 Report 2005.* Carlton: Curriculum Corporation.

Ministerial Council on Education, Employment, Training and Youth Affairs (MCEETYA), (2006). *National Assessment Program – Civics and Citizenship Years 6 & 10 Report 2004.* Carlton: Curriculum Corporation.

OECD (2000). *Measuring student knowledge and skills: The PISA 2000 assessment of reading, mathematical and scientific literacy.* Paris: OECD.

OECD (2006). *Assessing scientific, reading and mathematical literacy.* Paris: OECD.

Schultehis, C. (1990). *A study of the relationship between gender and reading preferences in adolescents.* Ohio: Kent State University

Steering Committee for the Review of Government Service Provision (2007). *Overcoming Indigenous disadvantage: Key indicators report for 2007*. Canberra: Productivity Commission SCRGSP.

Strein, W. (1993). Advances in research on academic self concept: Implications for school psychology. *School Psychology Review*, 22, 273 – 284.

Zimmerman, B. J. (1999). Commentary: towards a cyclically interactive view of self-regulated learning. *International Journal of Educational Research*, 31, 545 – 551.

Contextual factors that influence the achievement of Australia's Indigenous students: Results from PISA 2000 – 2006

ISBN 978-0-86431-901-2

www.oecd.org • www.ozpisa.acer.edu.au