Programme for International Student Assessment

PISA Australia in Focus Number 3

Motivation

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SECTION A

Australian students: Motivation to achieve

What is motivation?

Motivation is broadly defined as a constellation of closely related beliefs, perceptions, values, interests and actions. Motivation within individuals tends to vary across subject areas, and over time, with motivation for particular subject areas increasing with age and subsequently predicting motivation in later life (Lai, 2011). According to Fleming and Gottfried (1995), motivation as applied to academic situations involves enjoyment of school learning characterised by a mastery orientation (that is a desire to master skills or knowledge as opposed to simply meeting external criteria or outperforming peers); curiosity; persistence; and the learning of challenging, difficult and novel tasks.

Motivation plays a key role in educational success and outcomes, influencing the selection of specific goals toward which students strive and increasing the amount of effort and energy that they expend in pursuit of these goals. Motivation is viewed in the literature as a significant factor in leading to increased learning and enhanced educational outcomes. Students' motivation to learn and achieve is integral in determining their preparedness for life-long learning as a core skill in the twenty-first century (Krapp & Prenzel, 2011).

PISA and motivation

PISA has collected information about student motivation in each cycle, but the types of motivation focused on has varied over the cycles in line with the major domain (or the main focus) of the assessment for that cycle – reading, mathematical or scientific literacy. For example, instrumental motivation for studying science was collected in 2006 and 2015, when scientific literacy was the major focus of the assessment.

The current section of this report, Section A, focuses on **achievement motivation** and **motivation evaluation** (also referred to as motivation calibration) from PISA 2015. Section B focuses on **instrumental motivation to learn science** from the 2006 and 2015 PISA cycles and changes in how students have responded to these items over time.

What is achievement motivation?

Achievement motivation is defined as a subjective and internal psychological drive, enabling individuals to pursue work they perceive to be valuable and prompting them to reach their goals. Achievement motivation is concerned with the interaction of personality and the immediate environment as an existing determinant of aspiration, efforts and persistence when an individual expects that performance will be evaluated as success or failure in relation to a standard of excellence (Singh, 2011). Achievement motivation is also a mindset to compete and compare with others. It captures both students' goals and desire to outperform others, their desire to work hard to master a task or their desire to perform and to persevere (Elliot & McGregor, 2001).

> Achievement motivation can involve a student comparing their performance with that of their peers, as well as a desire to master a task or skill. In this way, it can be *intrinsic* (when driven by a personal interest or enjoyment) and *extrinsic* (when driven by the rewards that come with being the best) at the same time.

According to Eccles and Wigfield (2002), achievement motivation is intrinsic when it is sparked by an interest or enjoyment, but extrinsic when it comes from the attainment of rewards such as good marks or praise from a teacher or parent. A student who is motivated to achieve and perform gains both intrinsic and extrinsic benefits from short-term and long-term learning opportunities (OECD, 2016a).

The importance of achievement motivation

Achievement motivation plays an important role in influencing future-orientated expectations and intentions, and promotes the mindset that helps students identify clear long-term career goals that are protective factors against school failure (Linnenbrink & Pintrich, 2002).

Motivating students to achieve is one of the major challenges teachers face in the classroom. Teachers provide their students with a plethora of learning opportunities in the hope of spurring enthusiasm, sparking curiosity and capturing and inspiring interest to pursue goals for their future aspirations. For some students, achievement motivation is driven by the desire to strive for the extrinsic 'carrot'. Teachers encourage students to study hard to receive the highest grade possible, to achieve the Australian Tertiary Admission Rank (ATAR) for entry into their desired tertiary course, or to get the job of their choice. For other students, achievement motivation may be driven by an intrinsic drive to learn all there is about a subject or to become accomplished at certain tasks.

How achievement motivation is measured in PISA 2015

PISA 2015 collected data about students' achievement motivation using their responses to the following five items measured on a four-point Likert scale (strongly agree; agree; disagree; and strongly disagree):

- *I want top grades in most or all of my courses.*
- *I want to be able to select from among the best opportunities available when I graduate.*
- *I want to be the best, whatever I do.*
- *I see myself as an ambitious person.*
- *I want to be one of the best students in my class.*

Responses of 'agree' or 'strongly agree' were combined and are referred to as agreement. An index, or overall scale, of achievement motivation was also derived from students' responses, scaled so that higher scores on the index reflected stronger agreement to the items, and thus a greater level of achievement motivation compared to the OECD average.

Achievement motivation across countries

Figure A.1 presents the mean scores on the achievement motivation index for participating countries in PISA 2015.

Students in Australia had a mean index score of 0.33 on the achievement motivation index, which was significantly higher than the OECD average[1] of - 0.01. This indicates that Australian students reported having a significantly higher level of achievement motivation compared to students across the OECD. Overall, six OECD countries recorded a higher level of achievement motivation than Australia, while 26 OECD countries recorded a lower level of achievement motivation than Australia, and Canada's level was equivalent to that of Australia.

> Australian students demonstrated higher achievement motivation than 26 OECD countries.
>
> Only six OECD countries demonstrated higher achievement motivation than Australia.

Clearly, high performance on PISA does not necessarily correspond to high achievement motivation. Some of the countries with the highest scores on achievement motivation were some of the lower performing countries.

Eleven countries, including both high-performing and culturally similar English-speaking countries were selected for comparison with Australia.

High-performing countries: Canada, Estonia, Finland, Hong Kong (China), Japan, Macao (China), and Singapore. These countries performed significantly higher in scientific, reading and mathematical literacy than Australia in PISA 2015.

Culturally similar English-speaking OECD countries: New Zealand, the United Kingdom, Ireland and the United States.

Among the high performing comparison countries, Finland, Japan, Macao (China) and Estonia all had mean scores on the achievement motivation index that were significantly lower than the OECD average (ranging from -0.63 in Finland to -0.50 in Macao (China)), while Hong Kong and Singapore's scores were significantly higher than the OECD average. The average scores of students in the culturally similar English-speaking countries were all higher than the OECD average (0.65 in the United States, and 0.51 in the United Kingdom). Australia and Canada reported similar levels of achievement motivation (0.33 respectively).

1 In this chapter, the OECD average refers to OECD average-35 – those countries who participated in PISA 2015.

Country	All students	
	Mean index	SE
Israel	0.83	0.02
United Arab Emirates	0.78	0.01
Qatar	0.77	0.01
Tunisia	0.67	0.02
United States	0.65	0.02
Turkey	0.62	0.02
United Kingdom	0.51	0.02
Costa Rica	0.51	0.01
Colombia	0.50	0.01
Singapore	0.41	0.01
Ireland	0.39	0.01
Iceland	0.39	0.02
Korea	0.34	0.02
Dominican Republic	0.34	0.02
Peru	0.34	0.01
Australia	**0.33**	**0.01**
Canada	0.33	0.01
Chile	0.29	0.01
Mexico	0.25	0.02
New Zealand	0.24	0.01
Thailand	0.24	0.01
Portugal	0.20	0.01
Hong Kong (China)	0.20	0.02
Cyprus	0.16	0.01
Sweden	0.15	0.02
Brazil	0.12	0.01
B-S-J-G (China)	0.11	0.01
Norway	0.10	0.02
Lithuania	0.00	0.02
OECD average - 35	**-0.01**	**0.00**
Chinese Taipei	-0.01	0.01
Latvia	-0.03	0.01
Estonia	-0.04	0.01
Uruguay	-0.05	0.01
Bulgaria	-0.06	0.02
Russia	-0.09	0.02
Greece	-0.10	0.02
Denmark	-0.15	0.02
Montenegro	-0.16	0.01
Spain	-0.16	0.02
Italy	-0.17	0.01
Luxembourg	-0.17	0.01
Croatia	-0.24	0.01
France	-0.25	0.02
Austria	-0.26	0.02
Czech Republic	-0.28	0.01
Slovak Republic	-0.28	0.01
Hungary	-0.30	0.01
Germany	-0.38	0.01
Poland	-0.42	0.01
Slovenia	-0.43	0.01
Switzerland	-0.43	0.01
Netherlands	-0.44	0.01
Belgium	-0.45	0.01
Macao (China)	-0.50	0.01
Japan	-0.51	0.02
Finland	-0.63	0.02

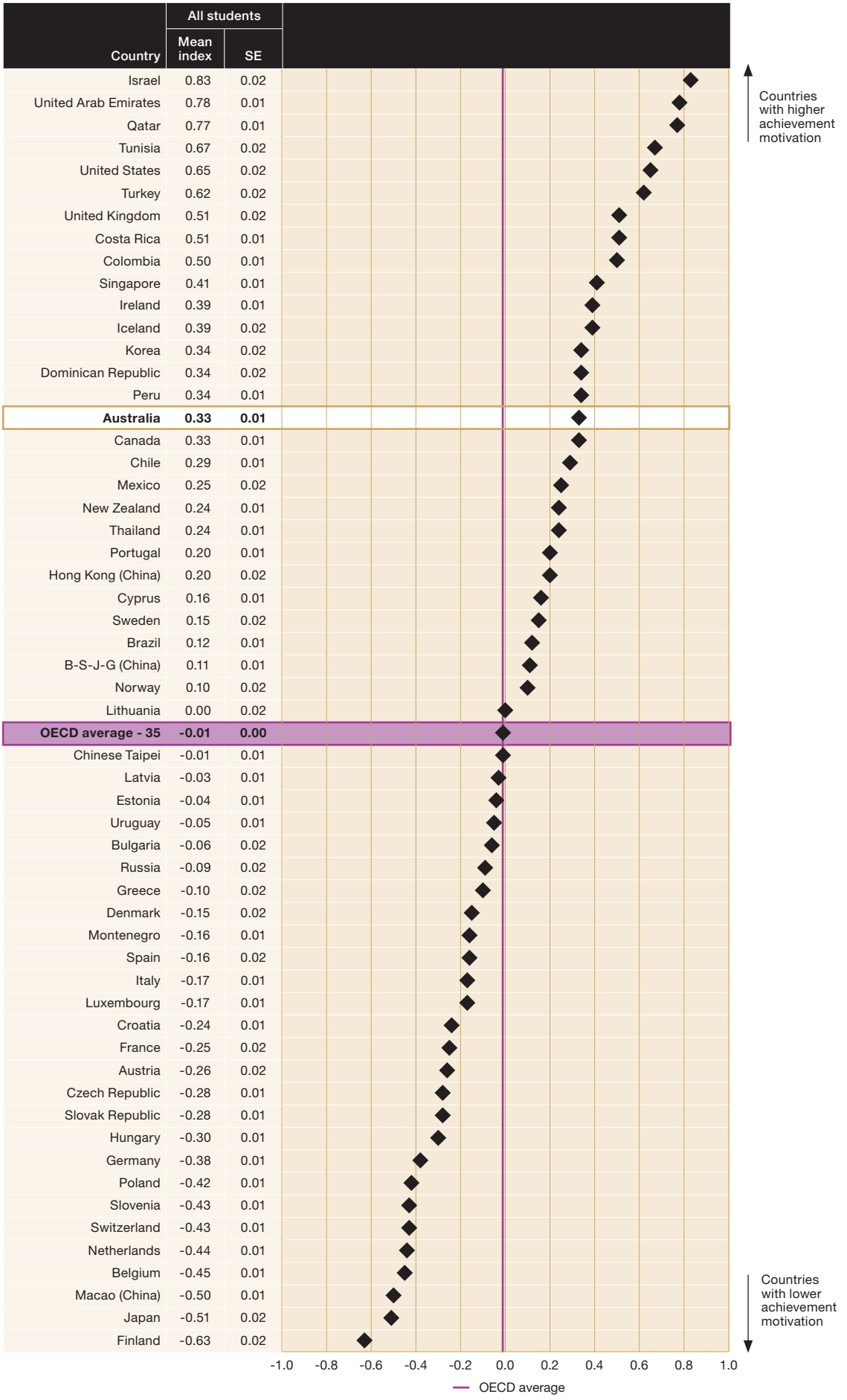

FIGURE A.1 Mean scores on the PISA 2015 achievement motivation index, by country

Achievement motivation and scientific literacy performance

Figure A.2 explores the relationship between achievement motivation (by quartiles) and scientific literacy performance. For Australian students there was a positive, albeit weak, relationship between achievement motivation and scientific literacy performance (r = 0.19). A similar weak positive relationship was found between achievement motivation and mathematical literacy performance (r = 0.21) and reading literacy performance (r = 0.20).

Australian students with higher achievement motivation scored 49 points higher on average in scientific literacy than students with low achievement motivation, which equates to nearly 2 years of schooling.

Australian students in the highest quartile of the index of achievement motivation scored 49 points higher in scientific literacy, on average, than those in the lowest quartile. This score point difference reflects the equivalent of around 2 years of schooling. This difference in performance between the most and the least achievement motivated students was larger than on average across the OECD, where students in the highest quartile of achievement motivation scored 38 points higher in scientific literacy, on average, than those in the lowest quartile.

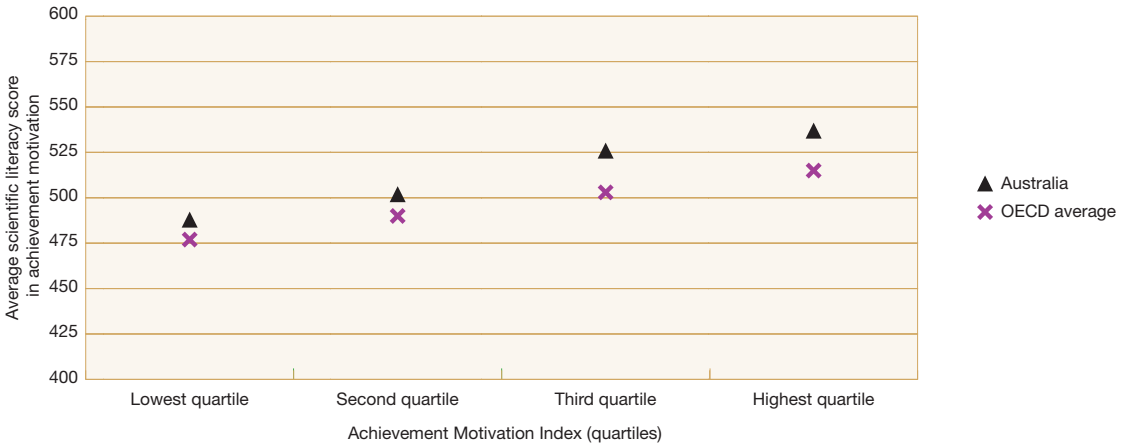

FIGURE A.2 Relationship between students' achievement motivation and scientific literacy scores for Australia and the OECD average

The relationship between achievement motivation and other measures that influence motivation also showed a weak positive association. For example, achievement motivation and enjoyment of science, r = 0.26; self-efficacy, r = 0.23 and interest in broad science topics, r = 0.21.

Figure A.3 presents the proportion of Australian students who agreed with each of the achievement motivation items compared to the proportion of students across OECD countries.

Higher proportions of Australian students compared to students on average across the OECD agreed with each of the achievement motivation items. The differences observed were:

- *I want to be the best, whatever I do*: 21 percentage points. This was the largest difference observed.
- *I want to be one of the best students in my class*: 15 percentage points.
- *I see myself as an ambitious person*: 10 percentage points.
- *I want to be able to select from among the best opportunities available when I graduate*: 3 percentage points. This was the smallest, statistically significant difference.

The largest difference between Australian students and OECD average was on the item *I want to be the best, whatever I do …*

87% of Australian students agreed compared to 65% of students across OECD countries

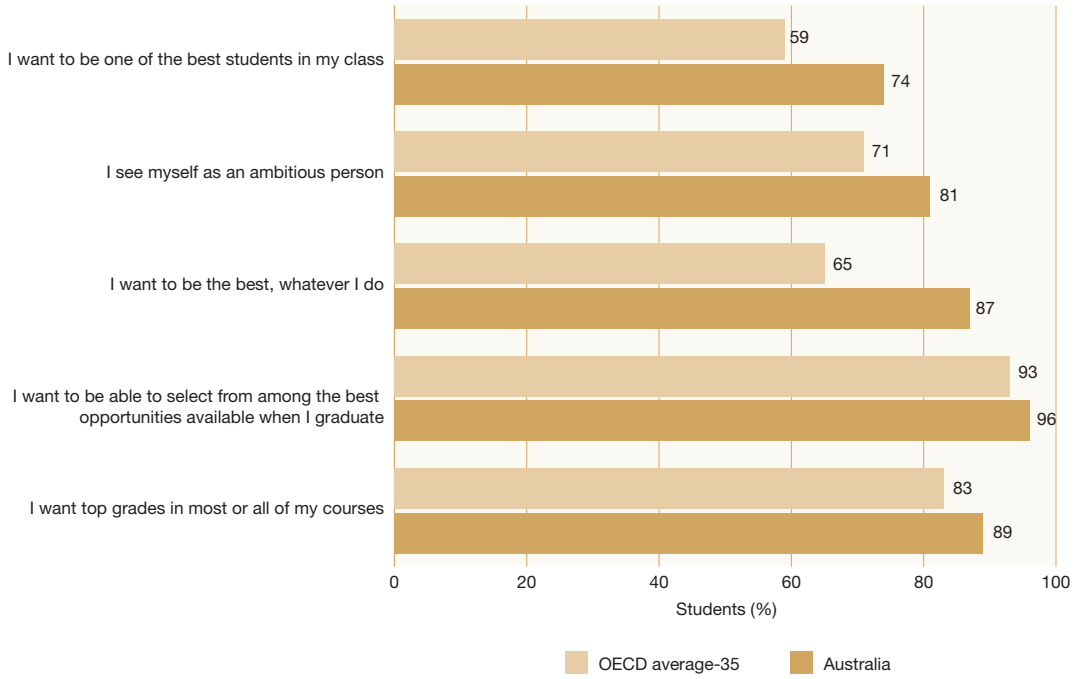

FIGURE A.3 Students' agreement with achievement motivation items for Australia and the OECD average

Table A.1 shows the percentage of students in the comparison countries who agreed with each of the achievement motivation items, along with results for Australia and the OECD average for comparison.

For comparison countries, the percentages of students who agreed with each achievement motivation item are as follows:

- *I want top grades in most or all of my courses*
  - **Lowest**: Macao (China), 50% of students.
  - **Highest**: United Kingdom, 95% of students
- *I want to be able to select from among the best opportunities available when I graduate*
  - **Lowest**: Finland, 80% of students.
  - **Highest**: United Kingdom, 98% of students.
- I *want to be the best, whatever I do*
  - **Lowest**: Finland, 36% of students.
  - **Highest**: United States, 93% of students.
- *I see myself as an ambitious person*
  - **Lowest**: Finland and Macao (China), 56% of students.
  - **Highest**: United States, 87% of students.
- *I want to be one of the best students in my class*
  - **Lowest**: Japan, 33% of students.
  - **Highest**: United States, 85% of students.

TABLE A.1 Students' achievement motivation, Australia and selected countries

	I want top grades in most or all of my courses		I want to be able to select from among the best opportunities available when I graduate		I want to be the best, whatever I do		I see myself as an ambitious person		I want to be one of the best students in my class	
Country	%	SE	%	SE	%	SE	%	SE	%	SE
Finland	61	0.9	*80*	0.7	*36*	0.9	*56*	0.9	41	0.9
Japan	65	0.8	87	0.5	39	0.8	58	0.8	*33*	0.7
Macao (China)	*50*	0.7	91	0.5	57	0.8	*56*	0.8	49	0.9
Estonia	92	0.5	95	0.3	66	0.7	75	0.7	51	0.7
Hong Kong (China)	88	0.5	94	0.4	82	0.5	64	0.9	75	0.7
Ireland	93	0.4	97	0.2	87	0.5	85	0.5	72	0.7
New Zealand	89	0.4	94	0.4	86	0.6	77	0.6	70	0.7
Canada	89	0.4	95	0.2	82	0.5	82	0.4	73	0.6
Singapore	88	0.4	96	0.2	89	0.5	75	0.6	82	0.4
United Kingdom	**95**	0.3	**98**	0.3	90	0.4	83	0.5	76	0.6
United States	94	0.4	97	0.2	**93**	0.4	**87**	0.6	**85**	0.5
Australia	**89**	**0.3**	**96**	**0.2**	**87**	**0.4**	**81**	**0.4**	**74**	**0.5**
OECD average - 35	**83**	**0.1**	**93**	**0.1**	**65**	**0.1**	**71**	**0.1**	**59**	**0.1**

Note: Highest index scores are presented in **bold**, lowest scores in *italics*

Achievement motivation across the Australian jurisdictions

Table A.2 shows a pairwise comparison of the mean scores on the achievement motivation index between jurisdictions. Students from New South Wales reported levels on the index significantly higher than for students in all other states but not significantly different to students from Victoria.

Students from Tasmania reported levels on the achievement motivation index that were significantly lower than all other jurisdictions in Australia, however still significantly higher than the OECD average.

> Students in NSW reported the highest levels of achievement motivation while students in Tasmania reported the lowest levels of achievement motivation.

TABLE A.2 Multiple comparison of Australian students' mean achievement motivation scores by jurisdiction

Jurisdiction	Avg. score	SE	NSW	VIC	SA	ACT	WA	NT	QLD	TAS	OECD average
NSW	0.41	0.02		●	▲	▲	▲	▲	▲	▲	▲
VIC	0.38	0.02	●		●	●	▲	▲	▲	▲	▲
SA	0.32	0.03	▼	●		●	●	●	▲	▲	▲
ACT	0.31	0.04	▼	●	●		●	●	▲	▲	▲
WA	0.28	0.03	▼	▼	●	●		●	●	▲	▲
NT	0.27	0.05	▼	▼	●	●	●		●	▲	▲
QLD	0.22	0.02	▼	▼	▼	▼	●	●		▲	▲
TAS	0.12	0.04	▼	▼	▼	▼	▼	▼	▼		▲
OECD average-35	**-0.01**	**0.00**	▼	▼	▼	▼	▼	▼	▼	▼	

Note: read across the row to compare a jurisdiction's performance with the performance of each jurisdiction listed in the column heading.

▲ Average performance statistically significantly higher than in comparison jurisdiction
● No statistically significant difference from comparison jurisdiction
▼ Average performance statistically significantly lower than in comparison jurisdiction

A high proportion of Australian students *want to be able to select from the best opportunities available when I graduate.* But fewer students agreed that they *want to be one of the best students in my class.*

Table A.3 shows the percentage of students in the Australian jurisdictions who agreed with each of the items that measured achievement motivation. The OECD average has been included for comparison.

All Australian jurisdictions recorded higher agreement with each of the five items than the OECD average. Well over 90 per cent of students *want to be able to select from among the best opportunities available when I graduate*. Around 90 per cent of students *want top grades in most or all of my courses*.

In contrast, the proportion of students who *see myself as an ambitious person* were slightly lower in the Northern Territory (77%), and Tasmania and the Australian Capital Territory (both 78%).

Overall, there was a greater spread of students by jurisdiction reporting they *wanted to be one of the best students in my class,* which ranged from 64% of students in Tasmania (the lowest percentage) through to 79% of students in New South Wales (the highest percentage).

TABLE A.3 Australian students' agreement with achievement motivation items by jurisdiction

	I want top grades in most or all of my courses		I want to be able to select from among the best opportunities available when I graduate		I want to be the best, whatever I do		I see myself as an ambitious person		I want to be one of the best students in my class	
Jurisdiction	%	SE	%	SE	%	SE	%	SE	%	SE
ACT	87	1.4	96	0.8	85	1.3	78	1.6	78	1.6
NSW	89	0.6	96	0.4	87	0.7	81	0.7	79	1.0
VIC	91	0.7	96	0.5	88	0.8	82	1.0	76	1.1
QLD	88	0.7	96	0.4	85	0.8	80	0.9	69	1.1
SA	90	0.7	95	0.6	87	1.0	82	1.0	72	1.2
WA	88	1.1	95	0.6	86	0.9	81	0.8	72	1.3
TAS	89	1.4	94	1.0	83	1.3	78	1.5	64	2.0
NT	91	1.7	97	0.7	85	1.8	77	2.4	72	2.4
OECD average - 35	**83**	**0.1**	**93**	**0.1**	**65**	**0.1**	**71**	**0.1**	**59**	**0.1**

Achievement motivation for different demographic groups in Australia

Figure A.4 shows the mean achievement motivation index scores for the different demographic groups of Australian students.

Sex: Female students reported significantly higher levels of achievement motivation than male students.

Indigenous background: Non-Indigenous students reported significantly higher levels of achievement motivation than Indigenous students.

Geographic location: Students from metropolitan schools reported significantly higher levels of achievement motivation than students from provincial schools, who in turn reported higher achievement motivation than students in remote schools.

Socioeconomic background: Students from the highest socioeconomic quartile reported significantly higher levels of achievement motivation than students in the other three quartiles.

Immigrant background: Australian-born students reported significantly lower levels of achievement motivation than first-generation and foreign-born students, and there was also a significant difference between first-generation and foreign-born students.

Despite these differences within Australia, the average achievement motivation scores for all demographic groups were significantly higher than the OECD average.

	Mean index	SE
Sex		
Females	0.36	0.01
Males	0.30	0.02
Indigenous background		
Indigenous	0.08	0.02
Non-Indigenous	0.34	0.01
Geographic location		
Metropolitan	0.39	0.01
Provincial	0.16	0.02
Remote	0.10	0.09
Socioeconomic background		
Lowest quartile	0.14	0.02
Second quartile	0.26	0.02
Third quartile	0.38	0.02
Highest quartile	0.55	0.02
Immigrant background		
Australian-born	0.25	0.01
First-generation	0.41	0.02
Foreign-born	0.54	0.03

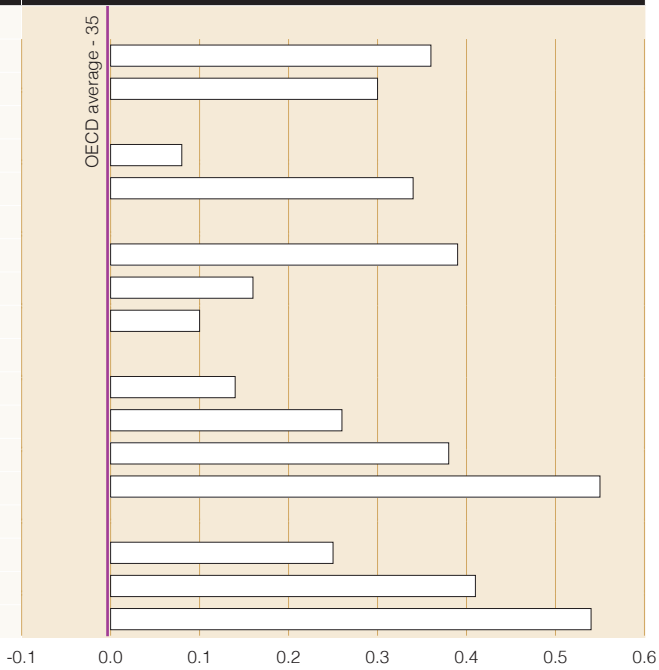

FIGURE A.4 Australian students' mean scores on the achievement motivation index by demographic groups

Table A.4 shows the percentage of students in each of the Australian demographic groups who agreed with each of the achievement motivation items, along with the OECD average for comparison.

> Australian-born students reported lower agreement to the item *I want to be one of the best students in my class* than students born outside Australia – 71% and 83% respectively.

While there were significant differences within the demographic groups, the majority were less than five percentage points. The following discussion will focus on only statistically significant differences greater than five percentage points.

Sex: Overall, any significant differences between the responses of male and female students were very small, and revealed similarly high levels of agreement with the achievement motivation items.

Indigenous background: There were also few significant differences in the responses of Indigenous and non-Indigenous students. This is of note given the very large differences in achievement between the two groups. The only substantial differences (which are still not particularly large) were that more non-Indigenous students than Indigenous students agreed that *I see myself as an ambitious person* (5 percentage point difference) and that *I want to be one of the best students in my class* (8 percentage point difference). These differences suggest that it is not lack of motivation inhibiting Indigenous students' achievement.

Geographic location: A higher proportion of students who attended schools in metropolitan areas compared to those who attended provincial or rural schools agreed that *I want top grades in most or all of my courses* (differences of just under 5 percentage points).

Agreement with the items *I see myself as an ambitious person* and *I want to be one of the best students in my class* was higher among students in metropolitan schools than among students in provincial and remote schools (differences of 5 percentage points and 10 percentage points, respectively).

Socioeconomic background: A significantly higher percentage of students in the highest socioeconomic background quartile compared to students in the lowest socioeconomic background quartile agreed that they *want top grades in most or all of my courses* (6 percentage points). There were also significant differences in endorsement of other 'competitive' items, with more students from the highest socioeconomic background quartile agreeing that *I see myself as an ambitious person* (10 percentage points) and *I want to be one of the best students in my class* (14 percentage points).

Immigrant background: The most striking difference was observed between the proportions of Australian-born and foreign-born students who agreed that *I want to be one of the best students in my class* – 83% of students born overseas agreed with this item compared to 71% of students born in Australia (to Australian-born parents).

TABLE A.4 Australian students' agreement with achievement motivation items

Demographic group	I want top grades in most or all of my courses		I want to be able to select from among the best opportunities available when I graduate		I want to be the best, whatever I do		I see myself as an ambitious person		I want to be one of the best students in my class	
	%	SE	%	SE	%	SE	%	SE	%	SE
Sex										
Females	91	0.4	97	0.3	86	0.6	81	0.6	75	0.7
Males	87	0.5	95	0.4	87	0.5	81	0.5	74	0.7
Indigenous background										
Indigenous	86	1.0	93	0.7	85	0.8	76	1.0	66	1.3
Non-Indigenous	89	0.3	96	0.2	87	0.4	81	0.4	75	0.5
Geographic location										
Metropolitan	90	0.4	96	0.2	87	0.4	82	0.4	77	0.5
Provincial	86	0.7	94	0.6	85	0.7	77	0.8	67	1.2
Remote	87	1.6	94	1.3	83	2.4	77	2.0	66	4.8
Socioeconomic background										
Lowest quartile	86	0.7	93	0.6	86	0.7	76	0.9	68	1.0
Second quartile	89	0.6	95	0.5	87	0.7	80	0.8	72	1.0
Third quartile	90	0.6	97	0.4	87	0.8	82	0.8	76	1.0
Highest quartile	92	0.6	98	0.4	87	0.7	86	0.7	82	0.7
Immigrant background										
Australian-born	88	0.4	95	0.3	86	0.5	80	0.5	71	0.6
First-generation	91	0.6	96	0.3	88	0.6	82	0.7	77	0.8
Foreign-born	92	0.7	97	0.5	88	0.8	82	1.3	83	1.1
OECD average-35	**83**	**0.1**	**93**	**0.1**	**65**	**0.1**	**71**	**0.1**	**59**	**0.1**

Motivation evaluation (calibration)

In 2015, PISA also collected data on **motivation evaluation**, also referred to as **motivation calibration**. According to Chen et al. (2017) motivation calibration refers to the ability of students to correctly assess what motivation looks like in day-to-day life, and to recognise motivation in others. Furthermore, it is argued, students cannot exhibit positive motivation behaviours if they do not know what these behaviours look like.

Motivation evaluation was a new area for PISA 2015, and the items used to measure this concept were different to those used to measure other aspects of motivation in previous cycles (such as achievement motivation). Students were asked to assess the motivation level of the three hypothetical scenarios listed below. The first scenario represented an example of a student with low motivation, the second scenario described a student with a medium level of motivation, and the final scenario described a student illustrating a high level of motivation. Students rated how strongly they agreed (or disagreed) that the student in each scenario was motivated.

> Please read the descriptions about the following three students. Based on the information provided here, how much would you disagree or agree with the statement that the student is motivated?
>
> Julian gives up easily when confronted with a problem and is often not prepared for his classes. *(Scenario illustrates low motivation).*
>
> Marina mostly remains interested in the tasks she starts and sometimes does more than what is expected from her. *(Scenario illustrates moderate motivation).*
>
> Adrian wants to get top grades at school and continues working on tasks until everything is perfect. *(Scenario illustrates high motivation).*

Students who 'agreed' or 'strongly agreed' that the student in the first scenario, Julian, was motivated demonstrated **a lack of recognition** of what a motivated student looks like, whereas if they 'disagreed' or 'strongly disagreed' with this item, they were demonstrating recognition of **low** motivation.

Students' who 'agreed' or 'strongly agreed' that the students in the second and third scenarios, Marina and Adrian, were motivated demonstrated recognition of what **moderate** and **high motivation** (respectively) looks like in others.

Motivation evaluation (calibration) across countries

Table A.5 shows the percentage of students from comparison countries who recognised motivation in others as measured with the hypothetical student scenarios described above. The OECD average has been included for comparison.

TABLE A.5 Students' motivation evaluation (calibration) for Australia and selected countries

	Percentage of students who agreed that:					
	Julian is motivated? Gives up easily when confronted with a problem and is often not prepared		Marina is motivated? Mostly remains interested in the tasks she starts and sometimes does more than expected		Adrian is motivated? Wants to get top grades at school and continues working on tasks until perfect	
Country	%	SE	%	SE	%	SE
Finland	4	0.3	93	0.4	93	0.4
Japan	3	0.2	95	0.3	97	0.3
Macao (China)	6	0.3	94	0.4	93	0.4
Estonia	7	0.4	92	0.4	95	0.4
Hong Kong (China)	6	0.4	95	0.4	94	0.4
New Zealand	7	0.4	88	0.5	96	0.3
Ireland	4	0.4	94	0.4	97	0.3
Canada	5	0.3	88	0.3	96	0.2
Singapore	4	0.3	94	0.4	96	0.2
United Kingdom	5	0.3	90	0.4	97	0.3
United States	5	0.4	91	0.4	97	0.3
Australia	**6**	**0.2**	**89**	**0.3**	**96**	**0.2**
OECD average - 35	**7**	**0.1**	**90**	**0.1**	**93**	**0.1**

Among the countries selected for comparison with Australia:

- The majority of students in all countries were able to identify what **low** motivation looks like (by recording low levels of agreement that Julian, the student in the first scenario, was motivated.
  - **Lowest:** Japan, 3% of students agreed (incorrectly) that Julian was motivated.
  - **Highest:** Estonia and New Zealand, 7% of students agreed that Julian was motivated.
- There was greater variation in responses to the second scenario, which described the behaviour of Marina, a **moderately motivated** student.
  - **Lowest**: Canada and New Zealand, 88% of students agreed that Marina was motivated.
  - **Highest**: Hong Kong (China) and Japan, 95% of students agreed that Marina was motivated.
- There were high levels of recognition of **high** motivation in all comparison countries, with over 90% of students agreeing that Adrian (in the third scenario) was motivated.
  - **Lowest:** Finland and Macao (China), 93% of students agreed that Adrian was motivated.
  - **Highest:** Japan, Ireland, United Kingdom and United States, 97% of students agreed that Adrian was motivated.

Motivation evaluation (calibration) for different demographic groups in Australia

Table A.6 shows the percentage of students from different demographic groups who recognised motivation in others as measured with the hypothetical student scenarios. The OECD average has been included for comparison.

Overall, and across the demographic groups, Australian students were able to recognise that the third scenario – *Adrian wants to get top grades at school and continues working on tasks until everything is perfect* – illustrates what a **highly motivated** student looks like, with agreement levels over 90% in every student group compared. Agreement that Marina in the second scenario was motivated tended to be slightly lower, suggesting that Australian students were not as sure of what a **moderately motivated** student looked like.

Female students appeared to be better able than their male peers to identify what **low**, **moderate** and **high** motivation looked like in others. While the differences between male and female students were statistically significant, they were small (less than 4 percentage points).

There were some interesting differences in the ability of different student groups to recognise **low** motivation. A significantly higher proportion of Indigenous students had difficulty correctly identifying **low** motivation, with 14% of Indigenous students agreeing that Julian in Scenario 1 was motivated compared to around 5% of non-Indigenous students.

A significantly higher percentage of students from remote schools compared to students from metropolitan schools had difficulty with identifying **low** motivation – 13% agreed that the item *Julian gives up easily when confronted with a problem and is often not prepared for his classes* described a motivated student compared to 5% of students in metropolitan schools.

Students from the lowest socioeconomic quartile also seemed to have difficulty correctly identifying **low** motivation compared to students in the highest socioeconomic quartile, with 9% and 3%, respectively, agreeing that Julian was motivated.

TABLE A.6 Australian students' motivation evaluation (calibration) by sex, Indigenous background, geographic location, socioeconomic background and immigrant background

	Percentage of students who agreed that:					
	Julian is motivated? Gives up easily when confronted with a problem and is often not prepared		Marina is motivated? Mostly remains interested in the tasks she starts and sometimes does more than expected		Adrian is motivated? Wants to get top grades at school and continues working on tasks until perfect	
Demographic group	%	SE	%	SE	%	SE
Sex						
Females	4	0.3	89	0.4	97	0.2
Males	7	0.4	88	0.4	94	0.3
Indigenous background						
Indigenous	14	0.8	87	0.9	93	0.6
Non-Indigenous	5	0.2	89	0.3	96	0.2
Geographic location						
Metropolitan	5	0.3	89	0.4	96	0.2
Provincial	7	0.5	88	0.7	94	0.5
Remote	13	0.9	83	2.6	95	0.9
Socioeconomic background						
Lowest quartile	9	0.6	87	0.6	94	0.4
Second quartile	6	0.5	88	0.7	95	0.5
Third quartile	4	0.4	90	0.7	97	0.3
Highest quartile	3	0.3	89	0.7	98	0.3
Immigrant background						
Australian-born	6	0.3	88	0.4	96	0.3
First-generation	4	0.4	90	0.6	97	0.4
Foreign-born	7	0.8	88	1.0	96	0.6
Australia average 2015	**6**	**0.2**	**89**	**0.3**	**96**	**0.2**
OECD average-35	**7**	**0.1**	**90**	**0.1**	**93**	**0.1**

SECTION B

Instrumental motivation to learn science over time

A student's **instrumental motivation** refers to how relevant they view different subject areas to their own lives and the external rewards they expect to receive from mastering the content and skills associated with the subjects (Eccles & Wigfield, 2002). In other words, instrumental motivation can be described simply as the answer to the question 'What's in it for me?'

Understanding how relevant students see science studies as being to their future is considered particularly topical in light of the declining number of students, and in particular girls, who choose to study science and STEM subjects in the later years of secondary school and in post-secondary education.

How PISA measures instrumental motivation in science

PISA measured students' **instrumental motivation for learning science** in the two cycles that focused on scientific literacy – 2006 and 2015. In both of these cycles, students were asked to indicate how strongly they agreed (or disagreed) with a number of items about the importance of learning science for either their future studies or job prospects. As with most non-cognitive items in PISA, responses to these items can be analysed at the individual item level, by comparing the proportions of students who agreed or disagreed, or by combining the items to form an index of instrumental motivation so that scores on the index can be compared.

In PISA 2006, five instrumental motivation to learn science items were included in the student questionnaire. In PISA 2015, one of these items was deleted and two were reworded, leaving four items (only two of which remained unchanged and thus directly comparable to those used in 2006):

- *Making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on (also used in 2006)*
- *Studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects. (also used in 2006)*
- *What I learn in my science subject(s) is important for me because I need this for what I want to do later on.*
- *Many things I learn in my science subject(s) will help me to get a job.*

Changes to the instrumental motivation items between these two cycles means that comparisons of index scores between 2006 and 2015 level are possible only at the national level (that is, between Australia and other countries).[2] Comparison of instrumental motivation within Australia, however, can be done using students' responses to two of the instrumental motivation items that have remained the same in 2006 and 2015.

Instrumental motivation across countries

Figure B.1 presents students' mean scores on the PISA 2015 instrumental motivation index for the comparison countries. Students in Singapore had the highest levels of instrumental motivation with a mean index score of 0.51, followed by students in Canada (0.46) and New Zealand and the United Kingdom (0.38).

Students in Australia had a mean score of 0.16 on the instrumental motivation index, which was significantly higher than the OECD average of - 0.14. While Australian students reported having a level of instrumental motivation that was significantly higher compared to students across the OECD, their instrumental motivation in the domain of science was substantially lower than among students in many of the countries selected for comparison here. Surprisingly, given their country's reputation in scientific and technological innovation and their own high achievement in scientific literacy (OECD, 2016b), students in Japan had a mean instrumental motivation for science score that was significantly lower than the OECD average.

	Mean index	SE
Singapore	0.51	0.01
Canada	0.46	0.01
New Zealand	0.38	0.02
United Kingdom	0.38	0.02
Ireland	0.36	0.02
United States	0.32	0.02
Hong Kong (China)	0.23	0.02
Macao (China)	0.20	0.01
Estonia	0.19	0.01
Australia	**0.16**	**0.01**
Finland	0.16	0.02
OECD average	**0.14**	**0.00**
Japan	-0.02	0.02

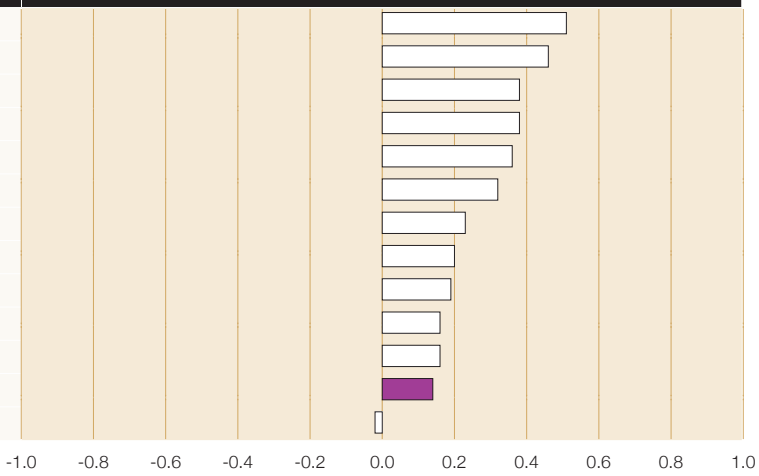

FIGURE B.1 PISA 2015 instrumental motivation to learn science index scores for selected countries and the OECD average

2 The index of instrumental motivation to learn science has been re-scaled to account for these changes only at the country level.

Changes in instrumental motivation to learn science within Australia

In Australia, from 2006 to 2015, students' instrumental motivation to learn science appears to have increased significantly.

Figure B.2 shows the percentage of students who agreed with the two instrumental motivation items for Australia and the OECD average. Between PISA 2006 and 2015, there was a small increase in agreement with the two instrumental motivation items that were administered. While the differences were statistically significant, in practical terms the percentage differences are generally small (less than 10 percentage points).

Making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on

In 2006, 66 per cent of Australian students agreed with this item, and by 2015 this increased to 70 per cent. This difference of four percentage points for Australia was similar to the increase reported on average over the OECD countries.

Studying my school science subject(s) is worthwhile for me because what I learn will improve my career prospects

In 2006, 64 per cent of Australian students agreed with this item and by 2015 this increased to 67 per cent. There was a similar increase in agreement with this item on average across the OECD countries.

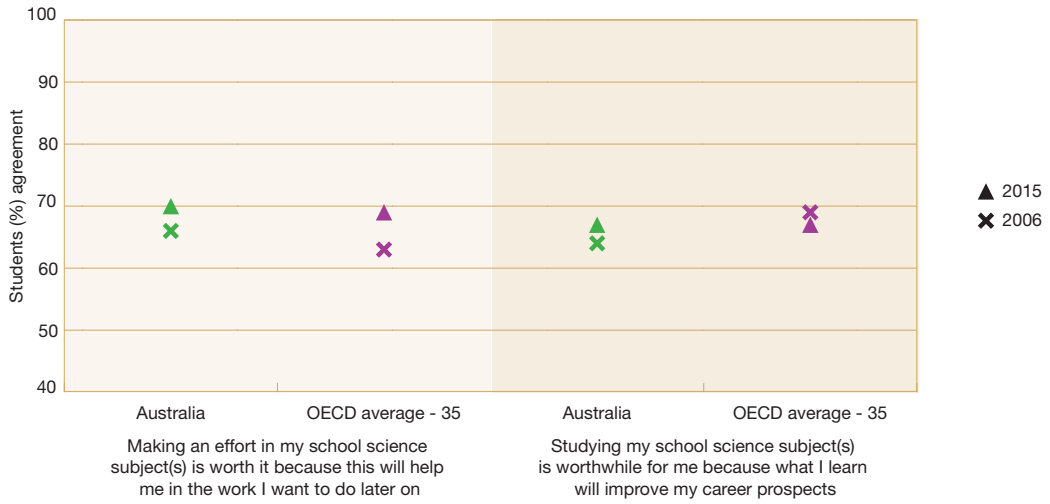

FIGURE B.2 Students' agreement with instrumental motivation to learn science items in PISA 2006 and 2015 for Australia and the OECD average

Changes in instrumental motivation to learn science for the comparison countries

Table B.1 presents the differences between the two items in the index of instrumental motivation to learn science that students responded to in both 2006 and 2015.

The most pronounced increase was in Japan where there was a very large increase (15 percentage points) between 2006 and 2015 in students who agreed that *making an effort in science is worth it because this will help me in the work I want to do later on*. Between 2006 and 2015 Macao (China) was the only country to report a significant decrease in agreement with this item.

Over the same time period, students in both Japan and Finland exhibited a large increase in the percentage of students who agreed that *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* (16 and 15 percentage points respectively). Despite the increases in agreement with these items, the average instrumental motivation scores of students in these two countries were relatively low in 2015, with Japan scoring lower than the OECD average (see Figure B.1).

In culturally similar comparison countries, New Zealand and the United Kingdom reported the largest increase in students' levels of instrumental motivation.

Among high performing countries, Japan and Finland reported the largest increase in agreement with instrumental motivation items.

TABLE B.1 Change in agreement with instrumental motivation to learn science items between 2006 and 2015 (PISA 2015 – PISA 2006)[3] for selected countries

	Making an effort in my school science subject(s) is worth it because this will help me in the work I want to do later on		Studying my school science subject(s) is worthwhile for me because what I learn will improve my career prospects	
Country	% dif.	S.E.	% dif.	S.E.
Japan	**15**	1.4	**16**	1.4
Finland	**12**	1.1	**15**	1.1
Ireland	**11**	1.2	**8**	1.3
United Kingdom	**8**	0.8	**6**	0.9
New Zealand	**9**	1.0	**7**	1.0
Canada	**8**	0.9	**7**	0.8
Estonia	**4**	1.0	**7**	1.0
OECD average	**5**	0.2	**6**	0.2
Hong Kong (China)	-1	1.0	**3**	1.0
Australia	**4**	0.8	**2**	0.8
United States	**2**	0.9	**4**	1.0
Macao (China)	**-7**	1.0	-2	1.1

Note: Values that are statistically significant are indicated in **bold**.
No data was available for Singapore in 2006.

3 Singapore has not been included in this table as data on instrumental motivation from PISA 2006 is not available.

Changes in instrumental motivation to learn science for different demographic groups in Australia

As indicated at the beginning of Section B, changes in instrumental motivation within Australia and among different groups of students are measured here using responses to the two items common to both the 2006 and 2015 PISA cycles:

- *Making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on;* and
- *Studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects*

Overall, agreement to these items has remained fairly stable among Australian students between PISA 2006 and 2015. Where there were changes in agreement to these items that reach statistical significance, they were still quite small. Figures are presented only where differences over time or between the groups reached statistical significance.

Sex

Over time - Agreement with the instrumental motivation items remained steady among both male and female students. The only significant change, while still small, was an increase in the proportion of male students who agreed that making an effort in science would help in the work they want to do later on (67% in 2006 to 71% in 2015).

Group comparisons - In 2006 and 2015, there were no significant differences between male and female students' reported levels of agreement with the two instrumental motivation items.

Indigenous background

Over time - Among Indigenous and non-Indigenous students, agreement with the item *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* remained unchanged (that is, not statistically different) between 2006 and 2015. There was a small increase in the proportion of non-Indigenous students who agreed that science would improve their career prospects – 67% in 2006 and 70% in 2015.

Group comparison - There were no significant differences between Indigenous and non-Indigenous students' percentage agreement to these items in either cycle.

Geographic location

Figure B.3 shows the percentage of students who agreed with the instrumental motivation items by geographic location.

Over time - While agreement to the item *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* has remained stable for all three groups of students between PISA 2006 and 2015, there were some interesting changes in agreement to *making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on*.

Among students in remote schools, agreement between 2006 and 2015 increased from 67% to 78% on this item. Agreement also increased significantly among students in metropolitan schools, from 66% in 2006 to 70% in 2015.

In 2015, the proportion of remote students who agreed that science would be important for what they want to do later in their lives was higher compared to metropolitan and provincial students. Agreement to this item had also increased among remote students between 2006 and 2015.

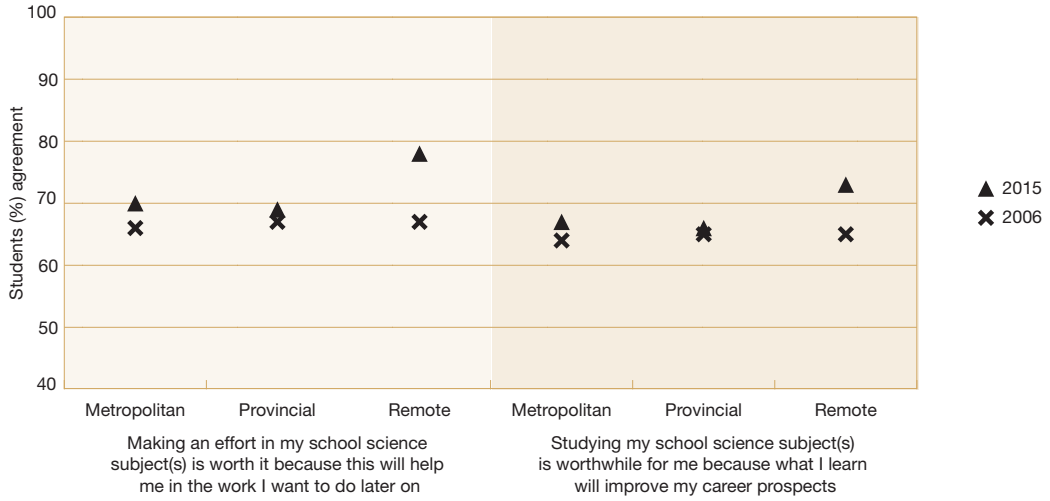

FIGURE B.3 Students' agreement with instrumental motivation to learn science items in PISA 2006 and 2015 by geographic location

Group comparison – In 2006, there were no significant group differences in agreement that *making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on.* In 2015, however, remote students' agreement with this item was statistically higher than either metropolitan students or provincial students'. This is an interesting finding given 47% of students from remote schools did not reach the National Proficient Standard in scientific literacy in 2015, and 28% of students from remote schools performed at or below Level 2 proficiency (Thomson et al, 2017).[4] Students from schools in remote areas may well be exhibiting a high level of resilience in order to overcome obstacles in order to achieve their desired goals. Despite their lower average performance in scientific literacy, the majority of remote students recognise the value their science learning might have in their futures.

4 This proficiency is considered so low as to put the student at risk of not being able to participate effectively and productively in life.

Socioeconomic background

Figure B.4 shows the percentage of students from each quartile of socioeconomic background who agreed with each of the items about instrumental motivation to learn science in PISA 2006 and 2015.

Over time - For all four groups of students, agreement to the item *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* remained unchanged between 2006 and 2015.

Agreement with the item *making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on* increased significantly between 2006 and 2015 among students in the two middle quartiles of socioeconomic background only, students in the highest and lowest quartiles recorded no significant changes.

Group comparison – Students from the lowest socioeconomic quartile recorded lower agreement on both items than students in other groups in both cycles.

In 2006, students in the lowest quartile reported lower agreement than students in the highest quartile that *making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on.* In 2015, students in the lowest quartile had lower agreement on this item than students in all three other groups.

Students in the lowest socioeconomic quartile recorded lower agreement to the item *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* than students in the other three socioeconomic groups in 2006. In 2015, the difference in agreement was significant only between students in the lowest and highest quartiles of socioeconomic background.

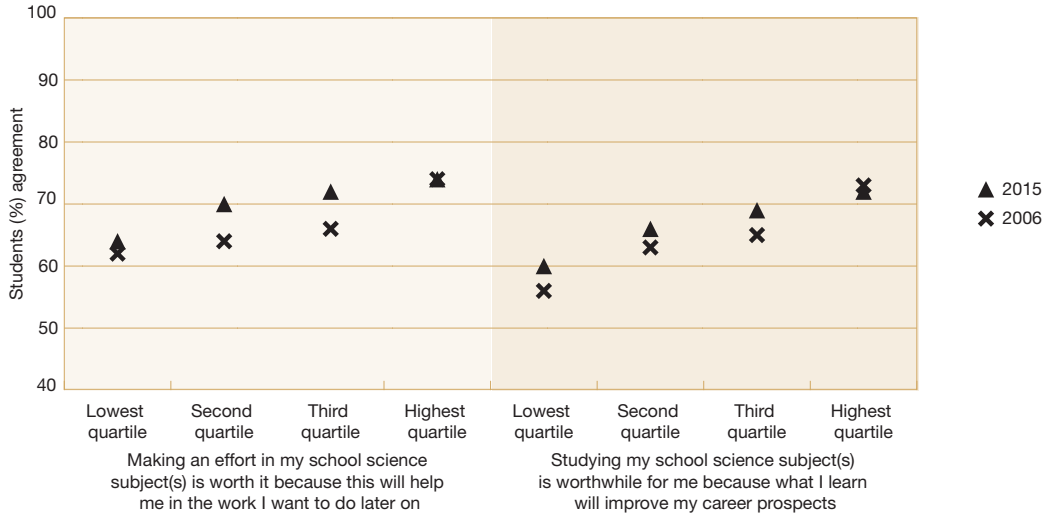

FIGURE B.4 Students' agreement with instrumental motivation to learn science items in PISA 2006 and 2015 by socioeconomic background

Immigrant background

Over time - The proportion of students who agreed that *studying my science subject(s) is worthwhile for me because what I learn will improve my career prospects* has remained unchanged in all three immigrant background groups between 2006 and 2015. In contrast, the proportion of Australian-born students who agreed that *making an effort in my science subject(s) is worth it because this will help me in the work I want to do later on* increased significantly over the same time (65% to 69%), but remained unchanged among first generation and foreign-born students.

Group comparison – Australian born and first generation students recorded lower agreement to both items than foreign-born students in 2006 and again in 2015.

The out of reach ‘carrot’ and its impact on students

Australian students demonstrated significantly higher levels of achievement motivation and instrumental motivation to learn science than on average across the OECD, which is encouraging given these students are at an age where there are many detractions and distractions from academic achievement (e.g. peer pressure to be popular, not wanting to be seen as a studious bookworm).

While motivation to achieve provides students with the impetus to set goals for their future and to strive toward attaining these goals, it should be acknowledged that an *overemphasis* on this form of motivation can impact negatively on student performance (Hancock, 2001).

Achievement motivation, as measured in PISA 2015, includes items that focus on students drawing comparisons between themselves and their peers and competing against their peers. Being driven by too high a level of motivation to achieve (in these terms of comparison and competition) can work against students and turn into a disabling form of perfectionism, especially among students who set (overly) ambitious goals and expectations. Students who are overly focused on their achievement, particularly in relation to others, can develop a fear of failure, resulting in procrastination, self-doubt, and mental exhaustion (Stroeber & Rambow, 2007). A forthcoming report will examine some negative consequences of emphasising students’ performance in relation to their peers, and explore students’ reports of test anxiety.

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Appendix A: Reader's guide to PISA

What is PISA?

The Programme for International Student Assessment (PISA) is an international study that measures how well 15-year-olds, who are nearing the end of their compulsory schooling in most participating education systems, are prepared to use their knowledge and skills in particular areas to meet real-life opportunities and 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, which increasingly address how well students are able to apply what they learn at school.

PISA in Australia

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

Unlike NAPLAN, PISA is not a curriculum-based assessment and assesses a nationally representative sample of 15-year-olds (rather than a year-level based sample), providing national and group estimates rather than providing individual student results.

The results collected from these assessments allow for nationally comparable reporting of progress towards the *Melbourne Declaration on Educational Goals for Young Australians* (MCEETYA, 2008), which set goals for high-quality schooling in Australia designed to secure students the necessary knowledge, understanding, skills and values for a productive and rewarding life.

The Australian Curriculum, Assessment and Reporting Authority (ACARA) reports on these assessments annually in its *National Report on Schooling in Australia*, which is the main vehicle for reporting against nationally agreed key performance measures defined in the *Measurement Framework for Schooling in Australia 2015* (Australian Curriculum, Assessment and Reporting Authority, 2015).

The *Measurement Framework for Schooling in Australia 2015* outlines national standards for each of the elements of the NAP, including PISA. The national standard for PISA is a proficient standard, which represents a 'challenging but reasonable' expectation of student achievement. This National Proficient Standard for PISA has been set at Level 3 on the PISA proficiency scales for each domain.

What are the main goals of PISA?

PISA looks to answer several important questions related to education, such as:

- How well are young adults prepared to meet the challenges of the future? Can they analyse, reason and communicate their ideas effectively? Will their skills enable them to adapt to rapid societal change?
- Are some ways of organising schools and school learning more effective than others?
- What influence does the quality of school resources have on student outcomes?
- What educational structures and practices maximise the opportunities of students from disadvantaged backgrounds?
- How equitable is the provision of education within a country and across countries?

What does PISA assess?

The core assessment domains of scientific literacy, reading literacy and mathematical literacy are measured in PISA. The PISA 2015 cognitive assessment also included the additional domain of collaborative problem solving and financial literacy.

How often is PISA administered?

Since 2000, PISA has been conducted every three years. In each cycle, three core assessment domains are rotated so that one domain is the major focus (the major domain), with a larger amount of the assessment time being devoted to this domain compared to the other two assessment domains (the minor domains).

PISA 2015 was the sixth cycle of PISA and scientific literacy was the major domain, which allowed an in-depth analysis and the reporting of results by subscale to be undertaken. The assessment of scientific literacy as a major domain in PISA 2015 also allows for changes in performance to be reported over a nine-year period, from PISA 2006 when scientific literacy was first assessed as a major domain (Table A.1).

TABLE A.1 Summary of the core assessment domains in PISA

PISA 2000	PISA 2003	PISA 2006	PISA 2009	PISA 2012	PISA 2015
Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy	Reading literacy
Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy	Mathematical literacy
Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy	Scientific literacy

Major domain Minor domain

What did participants do?

Students

Students completed a two-hour cognitive assessment. Students were also allowed up to 45 minutes to complete the student questionnaires, which they responded to after the completion of the PISA cognitive assessment. Students then undertook the financial literacy assessment.

Students were randomly assigned to a test form that comprised four 30-minute clusters of cognitive materials, with each cluster consisting of units that required them to construct responses to a stimulus and a series of questions. The stimulus material was typically a short written passage or text accompanying a table, chart, graph, photograph or diagram. A range of item-response formats, such as multiple choice questions and questions requiring students to construct their own responses, was used to cover the full range of cognitive abilities and knowledge identified in the Assessment Framework.[1]

Students were assigned three student questionnaires. These consisted of the internationally standardised student questionnaire, and two additional student questionnaires that were offered as international options: an information and communications technology (ICT) questionnaire and an educational career questionnaire. The student questionnaire sought information on students and their family background, aspects of students' lives, such as their attitudes towards learning, their habits and life in and outside of school, aspects of students' interest, motivation and engagement, and learning and instruction in science, including instructional time and class size. The ICT questionnaire collected information on the availability and use of ICT, students' perceptions of their competence in completing tasks and their attitudes towards computer use. The educational career questionnaire gathered information about whether students had experienced interruptions of schooling and their preparation for their future career.

School principals

Principals from participating schools were asked to complete a school questionnaire, which collected descriptive information about the school, including the quality of the school's human and material resources, decision-making processes, instructional practices and school and classroom climate.

Administration of PISA

Students completed the cognitive assessment and questionnaires using computers with the delivery of the PISA assessment on USB drives. The school principals and teachers completed their questionnaires online using logins to a secure website. In Australia, PISA 2015 took place during a six-week period from late July to early September 2015. For most countries in the Northern Hemisphere, the testing period took place between March and May 2015. Together with appropriate application of the student age definition, this resulted in the students in Australia being at both a comparable age and a comparable stage in the school year to those in the Northern Hemisphere who had been tested earlier in 2015.

1 The Assessment Framework explains the guiding principles behind the PISA 2015 assessment. Refer to the *PISA 2015 assessment and analytical framework* (OECD, 2016).

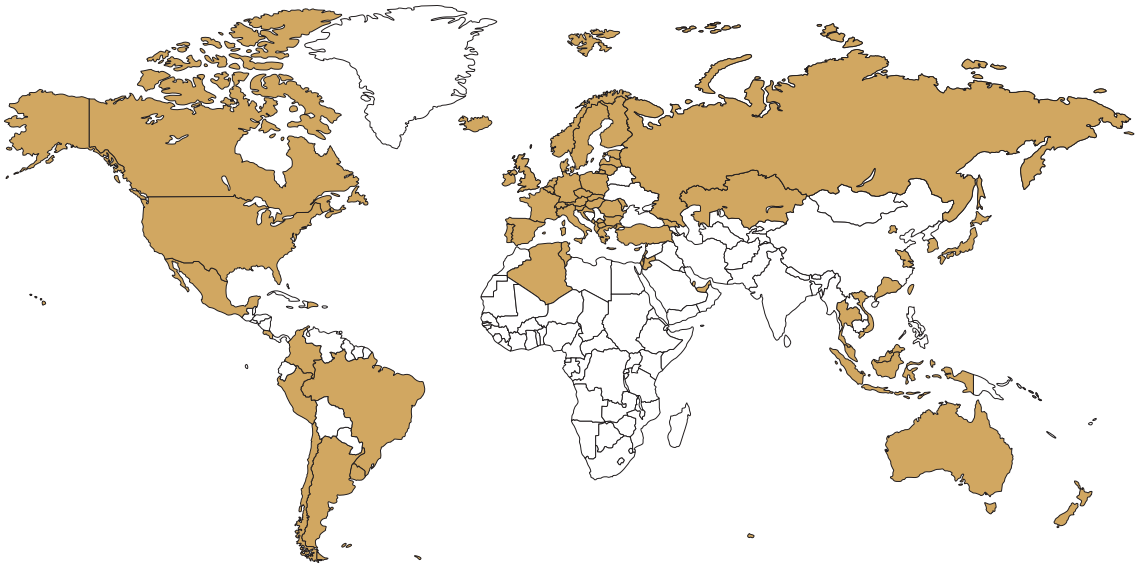
Who participates in PISA?

PISA aims to be as inclusive as possible of the population of 15-year-old students in each country and strict guidelines are enforced with regard to the percentage of schools and of students that could be excluded (which could not exceed 5% of the nationally desired target population).[2]

There are strict criteria on population coverage, response rates and sampling procedures. For initially selected schools, a minimum response rate of 85% (weighted and unweighted) was required, as well as a minimum rate of 80% (weighted and unweighted) of selected students. Countries that obtained an initial school response rate between 65% and 85% could still obtain an acceptable school response by the use of replacement schools. Schools with a student participation response rate lower than 50% were not regarded as participating schools. Australia successfully achieved the required response rates.

Countries

Although PISA was originally an OECD assessment created by the governments of OECD countries, it has become a major assessment in many regions and countries around the world. There were 72 countries and economies that participated in PISA 2015, including 35 OECD countries and 37 partner countries or economies (Figure A.1).[3]



OECD countries		
Australia	Hungary	Norway
Austria	Iceland	Poland
Belgium	Ireland	Portugal
Canada	Israel	Slovak Republic
Chile	Italy	Slovenia
Czech Republic	Japan	Spain
Denmark	Korea	Sweden
Estonia	Latvia	Switzerland
Finland	Luxembourg	Turkey
France	Mexico	United Kingdom
Germany	The Netherlands	United States
Greece	New Zealand	

Partner countries/economies		
Albania	Former Yugoslav	Moldova
Algeria	Republic of Macedonia	Montenegro
Argentina†	Georgia	Peru
Brazil	Hong Kong (China)	Qatar
B-S-J-G (China)*	Indonesia	Romania
Bulgaria	Jordan	Russian Federation
Chinese Taipei	Kazakhstan†	Singapore
Colombia	Kosovo	Thailand
Costa Rica	Lebanon	Trinidad and Tobago
Croatia	Lithuania	Tunisia
Cyprus	Macao (China)	United Arab Emirates
Dominican Republic	Malta	Uruguay
	Malaysia†	Vietnam

* B-S-J-G (China) refers to the four PISA participating provinces: Beijing, Shanghai, Jiangsu and Guangdong.

† Results for Argentina, Malaysia and Kazakhstan have not been reported in this report because their coverage was too small to ensure comparability.

Note: 15 countries (Albania, Algeria, Argentina, Georgia, Indonesia, Jordan, Kazakhstan, Kosovo, Lebanon, the Former Yugoslav Republic of Macedonia, Malta, Moldova, Romania, Trinidad and Tobago, and Vietnam) administered PISA as a paper-based assessment.

Although 72 countries and economies participated in PISA 2015, only those countries with an average score higher than the lowest scoring OECD country, Mexico, have been reported in this publication. Further details are provided in the Reader's Guide.

FIGURE A.1 Countries and economies which participated in PISA 2015

2 Refer to Appendix B in *PISA 2015: Reporting Australia's results* (Thomson, De Bortoli & Underwood, 2017).

3 PISA 2015 assessed the economic regions of Beijing, Shanghai, Jiangsu and Guangdong [B-S-J-G (China)], Chinese Taipei, Hong Kong (China) and Macao (China). Economic regions are required to meet the same PISA technical standards as other participating countries. Results for an economic region are only representative of the region assessed and are not representative of the country. For convenience, this report refers to these economic regions as countries.

Schools

In most countries, 150 schools and 42 students within each school were randomly selected to participate in PISA. In some countries, including Australia, a larger sample of schools and students participated. This allowed countries to carry out specific national options at the same time as the PISA assessment and for meaningful comparisons to be made between different sectors of the population.

In Australia, a larger sample of schools and students participated in PISA to produce reliable estimates that would be representative of each of the Australian jurisdictions[4] and of Indigenous students. In order for comparisons to be made between jurisdictions, it was necessary to oversample the smaller jurisdictions, because a random sample proportionate to jurisdiction populations would not yield sufficient students in the smaller jurisdictions to give a result that would be sufficiently precise. Further, a sufficiently large sample of Australia's Indigenous students was required so that valid and reliable separate analyses could be conducted.

The Australian PISA 2015 school sample consisted of 758 schools (Table A.2). The sample was designed so that schools were selected with a probability proportional to the enrolment of 15-year-olds in each school. Stratification of the sample ensured that the PISA sample was representative of the Australian population of 15-year-olds. Several variables were used in the stratification of the school sample including jurisdiction, school sector, geographic location, sex of students at the school and a socioeconomic background variable.[5]

TABLE A.2 Number of Australian PISA 2015 schools, by jurisdiction and school sector

	Sector			
Jurisdiction	Government	Catholic	Independent	Total
ACT	25	8	9	42
NSW	105	44	28	177
VIC	75	30	25	130
QLD	81	27	25	133
SA	55	22	21	98
WA	57	20	21	98
TAS	33	12	8	53
NT	15	5	7	27
Australia	**446**	**168**	**144**	**758**

Note: These numbers are based on unweighted data.

Of the Australian PISA schools, 87% were coeducational. Seven per cent of schools catered for all female students, while 6% catered for all-male students. Two per cent (15 schools) of the PISA 2015 schools were single-sex schools from the government school sector, 8% (58 schools) were from the Catholic school sector, and 3% (26 schools) were from the independent school sector.

Students

The target population for PISA is students who are aged between 15 years and 3 months and 16 years and 2 months at the beginning of the testing period and are enrolled in an educational institution, either full- or part-time. Since the largest part (but not all) of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

In each country, a random sample of 42 students was selected with equal probability from each of the randomly selected schools using a list of all 15-year-old students submitted by the school. Approximately 540 000 students took part in PISA 2015, representing about 29 million 15-year-old students internationally.

4 Throughout this report, the Australian states and territories are collectively referred to as jurisdictions.

5 Based on the Australian Bureau of Statistic's Socio-Economic Indexes for Areas.

Australia's PISA 2015 students

Across the jurisdictions

In most Australian jurisdictions, 20 students and all age-eligible Indigenous students were sampled per school. In the Australian Capital Territory, 30 students and all age-eligible Indigenous students were sampled per school, and in the Northern Territory, 27 students and all age-eligible Indigenous students were sampled per school. The Australian PISA 2015 sample of 14 530 students, whose results feature in the national and international reports, was drawn from all jurisdictions and school sectors according to the distributions shown in Table A.3.

TABLE A.3 Number of Australian PISA 2015 students, by jurisdiction and school sector

Sector		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Government	N students	496	2053	1253	1905	922	1104	654	275	8662
	Weighted N	2304	46660	36144	31221	10273	16236	3710	1377	147925
Catholic	N students	210	849	530	579	391	355	248	115	3277
	Weighted N	1406	20634	14810	10784	4039	5635	1296	259	58863
Independent	N students	211	471	403	456	367	410	133	140	2591
	Weighted N	822	12906	13252	10903	3887	6356	944	472	49542
Australia	**N students**	**917**	**3373**	**2186**	**2940**	**1680**	**1869**	**1035**	**530**	**14530**
	Weighted N	**4532**	**80200**	**64206**	**52908**	**18199**	**28227**	**5950**	**2108**	**256330**

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

As the sample is age-based in PISA, the students come from various year levels but they are mostly from Years 9, 10 and 11. There are some variations to the year-level composition of the sample in the different jurisdictions as shown in Table A.4, because of differing school starting ages in different jurisdictions.

TABLE A.4 Percentage of Australian PISA 2015 students, by jurisdiction and year level

Jurisdiction	Year level					
	7	8	9	10	11	12
ACT			12	81	7	
NSW	^	^	12	81	6	
VIC	^	^	23	75	1	^
QLD		^	2	51	47	^
SA		^	8	87	5	^
WA			1	86	13	
TAS			32	68	^	
NT	^	^	8	79	13	
Australia	**^**	**^**	**11**	**75**	**14**	**^**

^ denotes percentages ≤ 1

Note: These percentages are based on unweighted data; the jurisdiction totals are reported as whole numbers without rounding off decimal places.

Table A.5 shows the number of Australian female and male students who participated in PISA by jurisdiction. There were equal proportions of females and males in four jurisdictions (the Australian Capital Territory, New South Wales, Victoria and Western Australia), while the proportion of males was higher than the proportion of females in: Queensland: 49% female; 51% male; South Australia: 49% female; 51% male; Tasmania: 48% female; 52% male; and Northern Territory: 49% female; 51% male.

TABLE A.5 Percentage of Australian PISA 2015 students, by jurisdiction and sex

Sex		Jurisdiction								Total
		ACT	NSW	VIC	QLD	SA	WA	TAS	NT	
Females	N students	441	1686	1102	1430	798	928	513	265	7163
	Weighted N	2254	40118	32163	25851	8828	14061	2835	1041	127151
Males	N students	476	1687	1084	1510	882	941	522	265	7367
	Weighted N	2278	40081	32043	27057	9370	14165	3116	1067	129177

Geographic location of schools

The locations of schools in PISA were classified using the MCEETYA Schools Geographic Location Classification (Jones, 2004). For the analysis in this report, only the broadest categories are used:

- metropolitan – including mainland capital cities or major urban districts with a population of 100 000 or more (e.g. Queanbeyan, Cairns, Geelong, Hobart)
- provincial – including provincial cities and other non-remote provincial areas (e.g. Darwin, Ballarat, Bundaberg, Geraldton, Tamworth)
- remote – including areas with very restricted or very little accessibility to goods, services and opportunities for social interaction (e.g. Coolabah, Mallacoota, Capella, Mount Isa, Port Lincoln, Port Hedland, Swansea, Alice Springs, Bourke, Thursday Island, Yalata, Condingup, Nhulunbuy).

Table A.6 shows about 75% of PISA 2015 participants attended schools in metropolitan areas, 25% were from provincial areas and the remaining 1% of participants attended schools in remote areas.

TABLE A.6 Number and percentage of Australian PISA 2015 students, by geographic location

Geographic location	N students	Weighted N	Weighted (%)
Metropolitan	9947	188606	74
Provincial	4065	64073	25
Remote	518	3650	1

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Indigenous background

Indigenous background is derived from information provided by the school, which was taken from school records. Students were identified as being of Australian Aboriginal or Torres Strait Islander descent. For the purposes of this report, data for the two groups are presented together under the term 'Indigenous students'.

Every student from a participating school who identified as Indigenous was sampled for Australia's PISA. Four per cent of the PISA sample was of Indigenous background. Table A.7 shows the number of Australian Indigenous and non-Indigenous students who participated in PISA.

TABLE A.7 Number and percentage of Australian PISA 2015 students, by Indigenous background

Indigenous background	N Students	Weighted N	Weighted (%)
Indigenous	2807	10659	4
Non-Indigenous	11723	245670	96

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Socioeconomic background

Information about students' socioeconomic background was collected in the student questionnaire. Students were asked several questions about their family and home background. This information was used to construct a measure of socioeconomic background: the economic, social and cultural status index (ESCS). The ESCS is based on three indices: the highest occupational status of parents (HISEI); the highest educational level of parents in years of education (PARED); and home possessions (HOMEPOS). The index of home possessions (HOMEPOS) comprises all items on the indices of family wealth (WEALTH), cultural resources (CULTPOSS), access to home educational and cultural resources and books in the home (HEDRES). It must be noted that there have been some adjustments to the computation of ESCS over the PISA cycles.

Using this index, participating students were distributed into quartiles of socioeconomic background. The distribution of Australian students by school sector is provided in Table A.8, and shows there were higher proportions of students from lower socioeconomic backgrounds who attended government schools (34%) compared to the proportions of students who attended Catholic schools (16%) or independent schools (10%). Conversely, there were lower proportions of students from higher socioeconomic backgrounds who attended government schools (17%) compared to the proportions of students who attended Catholic schools (29%) or independent schools (44%).

TABLE A.8 Number and percentage of Australian PISA 2015 students, by socioeconomic background quartiles and school sector

Socioeconomic background	Government			Catholic		
	N students	Weighted N	Weighted (%)	N students	Weighted N	Weighted (%)
Lowest quartile	3122	48261	34	577	9043	16
Second quartile	2212	38663	27	833	14671	25
Third quartile	1696	31483	22	927	17366	30
Highest quartile	1192	23596	17	888	16927	29

Socioeconomic background	Independent			Total weighted % of PISA population
	N students	Weighted N	Weighted (%)	
Lowest quartile	283	4828	10	25
Second quartile	486	8812	18	25
Third quartile	728	13366	28	25
Highest quartile	1045	21585	44	25

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample.

Immigrant status

The student questionnaire collected information about the country of birth of students and their parents. For the analysis in this report, immigrant background is defined by the following categories:

- Australian-born students – students born in Australia with both parents born in Australia
- first-generation students – students born in Australia with at least one parent born overseas
- foreign-born students – students born overseas with both parents also born overseas.

Table A.9 shows that just over 50% of students to sit PISA 2015 were Australian-born, 30% were first-generation and 12% of students were foreign-born.

TABLE A.9 Number and percentage of Australian PISA 2015 students, by immigrant background

Immigrant background	N students	Weighted N	Weighted (%)
Australian-born	8483	137006	53
First-generation	3795	76985	30
Foreign-born	1465	31468	12

Note: N students is based on the achieved (unweighted) sample; weighted N is based on the number of students in the target population represented by the sample. The weighted % doesn't sum to 100% as 4% of students didn't provide these details.

Target population for PISA

This report uses '15-year-olds' as shorthand for the PISA target population. In practice, the target population was students 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 and attending an educational institution full-time or part-time. Since the majority of the PISA target population is made up of 15-year-olds, the target population is often referred to as 15-year-olds.

Rounding of figures

Because of rounding, some numbers in tables may not exactly add to the totals reported. Totals, differences and averages are always calculated on the basis of exact numbers and are rounded only after calculation. When standard errors have been rounded to one or two decimal places and the value 0.0 or 0.00 is shown, this does not imply that the standard error is zero, but that it is smaller than 0.05 or 0.005 respectively.

Confidence intervals and standard errors

In this and other reports, student achievement is often described by an average score. For PISA, each average score is calculated from the sample of students who undertook PISA 2015 and is referred to as the sample average. The sample average is an approximation of the actual average score (known as the population average) that would have been obtained had all students in a country actually sat the assessment. Since the sample average is just one point along the range of student achievement scores, more information is needed to gauge whether the sample average is an underestimation or overestimation of the population average. The calculation of confidence intervals can indicate the precision of a sample average as a population average. Confidence intervals provide a range of scores within which we are confident that the population average actually lies.

In this report, each sample average is presented with an associated standard error. The confidence interval, which can be calculated using the standard error, indicates that there is a 95% chance that the actual population average lies within plus or minus 1.96 standard errors of the sample average.

Statistical significance

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

OECD average

An OECD average was calculated for most indicators in this report and is presented for comparative purposes. The OECD average corresponds to the arithmetic average of the respective country estimates, and can be used to compare a country on a given indicator with a typical OECD country.

- OECD average-35: refers to the average across all the 35 OECD countries in PISA 2015.
- OECD average-30: refers to the average across all the 30 OECD countries in PISA 2003, with the exception of Chile, Estonia, Israel, Slovenia and the United States.

PISA indices

The measures that are presented as indices summarise student responses to a series of related items constructed on the basis of previous research. In describing students in terms of each characteristic (e.g. self-efficacy in science, enjoyment of learning science), scales were originally constructed on which the OECD average was given an index value of 0,[6] and about two-thirds of the OECD population were given values between –1 and +1 (the index has a mean of 0 and a standard deviation of 1). Negative values on an index do not necessarily imply that students responded negatively to the underlying items. Rather, a student with a negative score responded less positively than students on average across OECD countries.

The indices are based on all categories for each item, whereas the reported percentages are collapsed into fewer categories. Due to this and the weighting of responses, a ranking based on the value of the indices will sometimes not exactly correspond to one based, say, on the average of the percentages.

Sample surveys

PISA is a sample survey and is designed and conducted so that the sample provides reliable estimates about the population of 15-year-old students. The PISA 2015 sample was a two-stage stratified sample. The first stage involved the sampling of schools in which 15-year-old students could be enrolled. The second stage of the selection process randomly sampled students within the sampled schools. The following variables were used in the stratification of the school sample: jurisdiction; school sector; geographic location; sex of students at the school; and a socioeconomic background variable (based on the Australian Bureau of Statistics' Socio-economic Indexes for Areas, which consists of four indexes that rank geographic areas across Australia in terms of their relative socioeconomic advantage and disadvantage).

Further information

PISA is an international comparative study which assesses a sample of 15-year-old students in reading, mathematical and scientific literacy. Further information about PISA in Australia, including the full national PISA 2015 report, is available from the national PISA website: www.acer.org/ozpisa/

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6 However, in instances where a scale has been used in a previous PISA cycle, the OECD average in PISA 2015 may not be equal to 0. This may be due to the increase in the number of OECD countries and/or changes in the responses to the items over time