

Measuring up: Canadian Results of the OECD PISA Study

The Performance of Canada's Youth in Science,
Reading, and Mathematics

2015 First Results for Canadians Aged 15

Highlights



cmeec

Canada

PISA 2015 Highlights



Canadian students achieve a high level of proficiency in science

According to the results of PISA 2015, Canada remains one of the top-performing countries in science. Close to 90 per cent of Canadian students and 79 per cent of students in OECD countries performed at or above Level 2 in science, which is the baseline level of science proficiency required for people to take advantage of further learning opportunities and to participate fully in modern society.

Overall, Canadian 15-year-old students achieved a mean score of 528 which is 35 points over the OECD average. Canada was outperformed by only three countries (Singapore, Japan, and Estonia) among all 72 participating countries and economies. Canadian students achieved strong results in each of the three science competencies assessed by PISA, as well as in the two knowledge areas and three content subscales. (See text box “What is PISA?” for definitions.)

The Canadian results are characterized by high levels of equity

The gap that exists between students with the highest and those with the lowest levels of performance is an important indicator of the equity of education outcomes. Canada was one of the few countries with above-average performance and below-average disparity in student performance. For Canada overall and for all provinces, the gap between the highest

and lowest levels of performance for science, reading, and mathematics is smaller than the OECD average, suggesting a high level of equity across the country in addition to high performance. At the provincial level, the smallest gap for science can be observed in Prince Edward Island (more equity) and the largest gap in Ontario (less equity).

There are variations between provinces in science achievement

Across provinces, the percentage of Canadian students at or above the baseline level of performance ranges from 83 per cent in Saskatchewan and Manitoba to over 90 per cent in Quebec, Alberta, and British Columbia. At the higher end of the PISA science scale, 12 per cent of Canadian students performed at Level 5 or above compared to 8 per cent performing at this level for all of the OECD. Provincially, the proportion of students achieving at this higher level is 10 per cent or more in Nova Scotia, Quebec, Ontario, Alberta, and British Columbia. At the lower end of the PISA scale, 11 per cent of Canadian students did not achieve Level 2; however, more than 60 countries had a higher proportion of students performing at the lower level compared to Canada.

At the provincial level, 15-year-old students in Quebec, Alberta, and British Columbia achieved higher average scores than the Canadian average, placing them among the top-performing participants globally. Only Singapore had higher achievement than these three jurisdictions. Students in Ontario performed at the Canadian average while the other provinces were below the Canadian average. All provinces scored higher than or as well as the OECD average in science. Alberta students stand out for performing better than Canada in all three competency subscales, both knowledge subscales, and in the three content areas. Quebec and British Columbia scored higher than or as well as the Canadian average in all these subscales while Ontario performed at the Canadian average.

What is PISA?

The Programme for International Student Assessment (PISA) was initiated by the member countries of the Organisation for Economic Co-operation and Development (OECD) to provide policy-oriented international indicators of the skills and knowledge of 15-year-old students and to shed light on a range of factors that contribute to successful students, schools, education systems, and learning environments. The assessment measures youth outcomes in reading, mathematics, science, collaborative problem solving, and financial literacy, focusing on what students can do with what they have learned in school, at home, and in the community.

PISA was first implemented in 2000 and is repeated every three years. In each cycle, one of three domains (science, reading, or mathematics) is chosen for a detailed assessment, while all other domains are evaluated in summary assessments. PISA 2015 was the sixth cycle of PISA to be completed, and it focused on scientific literacy, defined through three competencies, two knowledge types, and three areas of knowledge of science. PISA 2015 also measured students' interest in and awareness of science and environmental issues as well as their perceived value of scientific approaches.

Science competencies refer to how well students could:

- **Explain phenomena scientifically** — being able to recognize, offer, and evaluate explanations for a range of natural and technological phenomena;
- **Evaluate and design scientific enquiry** — being able to describe and appraise scientific investigations and propose ways of addressing questions scientifically; and
- **Interpret data and evidence scientifically** — being able to analyze and evaluate data, claims, and arguments in a variety of representations and draw appropriate scientific conclusions.

Knowledge types included:

- **Content knowledge** — knowing the facts, concepts, ideas, and theories that science has established about the natural world;
- **Procedural knowledge** — demonstrating an understanding of how scientific knowledge is derived; and
- **Epistemic knowledge** — demonstrating an understanding of the role of specific constructs and defining features essential to the process of knowledge building in science.

Content knowledge areas involved:

- **Physical systems** — for example, demonstrating an understanding of the particle model of matter;
- **Living systems** — for example, demonstrating an understanding of the theory of evolution by natural selection; and
- **Earth and space systems** — for example, demonstrating an understanding of the history and scale of the universe.

As minor domains in PISA 2015, reading, mathematics, and collaborative problem solving were measured at only an overall rather than a detailed level. Seven provinces also participated in the financial literacy option (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Ontario, Manitoba, and British Columbia). Results from the financial literacy and collaborative problem-solving components will be released in 2017.

PISA 2015 assessed all subjects for the first time via computer, although paper-based assessment instruments were provided for countries that chose not to test their students by computer. Contextual questionnaires were also administered to students and school principals to collect data on student, family, and school factors that can help explain differences in performance.

Seventy-two countries participated in PISA 2015, including all 35 OECD countries. Between 5,000 and 10,000 students aged 15 from at least 150 schools were typically tested in each country. However, in Canada, approximately 20,000 15-year-olds from about 900 schools participated across the ten provinces. The large Canadian sample was required to produce reliable estimates representative of each province and for both French- and English-language school systems in Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia. PISA was administered in English and in French according to the respective school system. Because of a low school response rate, results for the province of Quebec should be treated with caution because of a possible non-response bias (see Appendix A of the Canadian report for further details).

Canadian students perform well in reading and mathematics in a global context

On average, Canadian 15-year-olds performed well in reading and mathematics with an average score of 527 in reading and 516 in mathematics, well above the OECD average of 493 and 490, respectively.

Among the 72 countries that participated in PISA 2015, only one outperformed Canada in reading while six outperformed Canada in mathematics.

Countries and provinces performing better than or as well as Canada in science, reading, and mathematics

	Better than Canada	As well as Canada
Science	Singapore, Alberta , British Columbia , Japan, Quebec, Estonia	Chinese Taipei, Finland, Macao–China, Vietnam, Ontario , Hong Kong–China, BSJG–China
Reading	British Columbia, Singapore	Alberta , Quebec , Ontario , Hong Kong–China, Finland, Ireland, Nova Scotia , Prince Edward Island
Mathematics	Singapore, Hong Kong–China, Quebec , Macao–China, Chinese Taipei, Japan, BSJG–China	Korea, British Columbia , Switzerland, Estonia, the Netherlands, Alberta , Denmark, Finland

In Canada, science results show significant differences by the school system's language

In Canada overall and in New Brunswick and British Columbia, there was no difference between the two language systems in science performance. The remaining provinces show a statistically different performance on the overall science scale between the anglophone and the francophone school systems. Students in the majority-language systems (students in the anglophone school systems in Nova Scotia, Ontario, Manitoba, and Alberta and students in the francophone school system in Quebec) performed better than their counterparts in the minority-language system.

In reading, the difference between students in the anglophone school systems and those in the francophone school systems was not statistically significant across Canada. However, at the provincial level, students in the majority-language school systems outperformed their peers in the minority-language school systems in five of the seven provinces (Nova Scotia, Ontario, Manitoba, Alberta, and British Columbia). In mathematics, students in francophone school systems in Canada overall, New Brunswick, and Quebec performed better than their anglophone counterparts.

There is no gender gap in science in Canada overall

In science overall, there was no difference in average achievement scores between boys and girls in Canada and the provinces. Overall, there was a higher proportion of boys than girls performing at the highest levels of proficiency (Levels 5 and 6) as well as at the lowest levels of proficiency (below

Level 2) in science. Provincially, more boys than girls performed at the highest levels of proficiency in Newfoundland and Labrador and Quebec while no gender differences were observed in any of the provinces at the lowest levels of proficiency.

As was the case since PISA 2000, girls performed significantly better than boys in PISA 2015 on the reading test in all countries and in all provinces. On average across OECD countries, girls outperformed boys in reading by 27 points in PISA 2015, while in Canada, this difference was 26 points. At the provincial level, the gender gap favouring girls ranged from 18 points in Newfoundland and Labrador to 36 points in Prince Edward Island. In mathematics, on average across OECD countries,

boys had a statistically significantly higher score than girls, but the eight-point difference was small compared to the large gender gap in reading. In Canada, boys outperformed girls in mathematics by nine points. Across the provinces, a gender gap favouring boys was observed in Newfoundland and Labrador, Quebec, Ontario, Alberta, and British Columbia, with no significant gender differences in mathematics observed in the remaining provinces.

The mean performance of Canadian students in science has remained stable over time

PISA 2015 provides the fourth assessment of science since 2006 when the first full assessment of science took place. In Canada, as well as across the OECD countries, science performance did not change between 2006 and 2015. In 2006, Canada's average performance in science was at its highest with a score of 534 points: Canada ranked third after Finland (563) and Hong Kong–China (542). Since then, Canadian results have remained very stable with average scores of 529, 525, and 528 points in 2009, 2012, and 2015 respectively. Provincially, no significant change in science achievement was observed in most provinces, with the exception of Newfoundland and Labrador, Manitoba, and Saskatchewan where the average score decreased by approximately 20 points.

Another way to study trend results is to look at the change in the proportion of students at the various levels of achievement. The proportion of high-performing students (at Levels 5 and 6) also did not change significantly over the 2006-to-2015 period although provincially, the proportion decreased in Newfoundland and Labrador, Manitoba, and Saskatchewan. At the Canadian level, the proportion of low-performing (below Level 2) 15-year-old students remained stable in science between 2006 and 2015. However, the proportion of students achieving below Level 2 has increased in Newfoundland and Labrador and Manitoba.

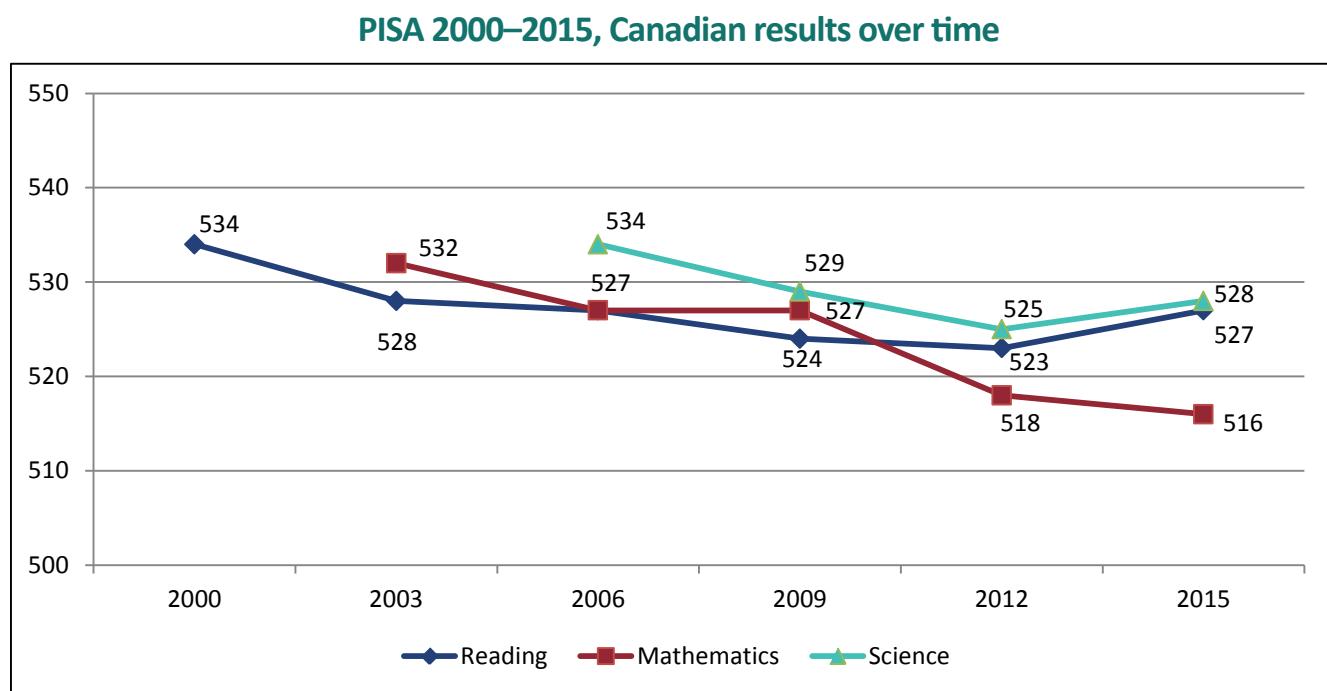
Canadian students' performance in reading remained relatively stable over time while performance in mathematics stabilized between 2012 and 2015

PISA 2015 is the sixth assessment of reading since 2000, when the first major assessment of reading took place. Between 2000 and 2015, the performance of Canadian 15-year-olds in reading has not changed significantly. The average scores were 534 in 2000 and 527 in 2015. Over this period, a decrease was noted in two provinces (Alberta and Saskatchewan by 33 and 31 points respectively), while there was no significant change in the other provinces. Since 2009, when reading was also a major domain, reading performance remained stable in all provinces except for Prince Edward Island where a significant improvement was observed over the 2009–2015 period.

PISA 2015 is the fifth assessment of mathematics since 2003, when the first major assessment of mathematics took place. After a significant decline between 2003 and 2012, the performance of Canadian students in mathematics remained unchanged between 2012 and 2015. Overall, the Canadian average score decreased significantly between 2003 (532 points) and 2015 (516 points). Over this period, a significant change was noted in all provinces except in Prince Edward Island and Quebec with decreases of over 30 points in Manitoba, Alberta, Saskatchewan, and Newfoundland and Labrador. Since 2012, when mathematics was also a major domain, Canada's performance remained

stable. Provincially, only Prince Edward Island and Saskatchewan observed a change in their students' mathematics performance over this period.

Saskatchewan experienced a significant decline while Prince Edward Island showed a significant increase in mathematics performance.



Looking forward

The PISA 2015 results suggest that in Canada a majority of students have attained a level of scientific literacy that enables them to use their knowledge and skills to engage with issues and ideas related to science.

The results of this assessment provide both affirmation and direction for Canadian jurisdictions and classrooms. While students appear to understand what is expected of them in science and appear to practise the key aspects when completing scientific tasks, there is room for improvement because there are numerous students below the baseline level (Level 2) for whom science remains a challenging subject.

Results from PISA 2015 provide an opportunity to confirm the success of our world-class education systems from a global perspective. Canada remains in the group of top-performing countries and achieves its standing with relatively equitable outcomes. The trend in decreasing average scores noted in past PISA cycles stabilized in 2015. However, results

from PISA as well as other pan-Canadian and international assessments show that several provinces have experienced a decline in the skill levels of their youth over the past decade.

Further analysis of the information collected through PISA will help us all gain a better understanding of the extent to which important background variables contribute to the differences in performance highlighted here. Reports on such secondary analysis will be available in forthcoming publications of *Assessment Matters!* (a series of articles available on the CMEC Web site).

The next PISA assessment is planned for 2018 with reading as the major domain and a new and innovative assessment of global competence expected to evaluate students' capacity to apply their knowledge, perspective-taking, and analytical and evaluation skills to tasks referring to relevant intercultural and global issues.

Further Canadian results are available in the report, **Measuring up: Canadian Results of the OECD PISA Study — The Performance of Canada's Youth in Science, Reading, and Mathematics — PISA 2015 First Results for Canadians Aged 15**.

This publication is available electronically at: www.cmec.ca.