Measuring up: Canadian Results of the OECD PISA Study

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

2012 First Results for Canadians Aged 15

Highlights

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Canada

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Highlights

Canadian students continue to perform well in mathematics in a global context

As was the case in past PISA cycles, Canada's 15-year-olds continue to perform very well in mathematics in a global context. Among all 65 participating countries, only nine performed better than Canada: Shanghai-China, Singapore, Hong Kong-China, Chinese Taipei, Korea, Macao-China, Japan, Liechtenstein, and Switzerland. Canadian students achieved strong results in each of the three processes assessed by PISA, as well as in the four content areas. (See text box "What is PISA?" for definitions.)

In Canada there are marked variations between provinces

At the provincial level, only 15-year-old students in Quebec performed above the Canadian average, and they were surpassed by only five countries. Students in Ontario, Alberta, and British Columbia performed at the Canadian average, while those in the remaining provinces were below the Canadian average. Prince Edward Island was the only province whose score was below the OECD average.

An analysis of results by mathematical processes also reveals provincial differences. Only students in Quebec achieved above the Canadian average in each of the three processes. Students in Ontario, Alberta, and British Columbia achieved at the Canadian average in the three processes, and students in the other provinces were below.

In terms of mathematical content areas, the smallest difference between provinces is found in the areas of *Change and Relationships* and *Uncertainty and Data,* while the largest difference is observed in the area of *Space and Shape.* Only Quebec performed above the Canadian average in all four content areas, while three provinces (Ontario, Alberta, and British Columbia) were at the average. The remaining six provinces were below the Canadian average in all four areas.

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 of 15-year-old students that are essential for full participation in modern societies. It assesses youth outcomes in reading, mathematics, science, 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 (mathematics, reading, or science) is chosen for a detailed assessment, while all other domains are evaluated in summary assessments. PISA 2012 was the fifth cycle of PISA to be completed, and it focused on mathematical literacy, defined through three process areas and four content knowledge areas.

Process areas comprised:

- **Formulating situations mathematically:** being able to recognize and identify opportunities to use mathematics and then provide mathematical structure to a problem presented in some contextualized form by translating it into a mathematical form.
- **Employing mathematical concepts, facts, procedures, and reasoning:** being able to employ these elements to solve mathematically formulated problems.
- **Interpreting, applying, and evaluating mathematical outcomes:** being able to reflect upon mathematical solutions, results, or conclusions and interpret them in the context of real-life problems.

Content knowledge areas comprised:

- **Change and Relationships:** the study of temporary and permanent relationships among phenomena, where changes occur within systems of interrelated objects or phenomena whose elements influence one another.
- **Space and Shape:** the study of visual phenomena that are encountered everywhere in our world — patterns, properties of objects, positions and orientations, representations of objects, decoding and encoding of visual information, navigation, and dynamic interaction with real shapes and representations.
- **Quantity:** the quantification of phenomena, relationships, situations, and entities in the world; understanding representations of those quantifications; and judging interpretations and arguments based on quantity.
- **Uncertainty and Data:** recognizing the place of variation in processes, having a sense of the quantification of that variation, acknowledging uncertainty and error in measurement, and knowing about chance.

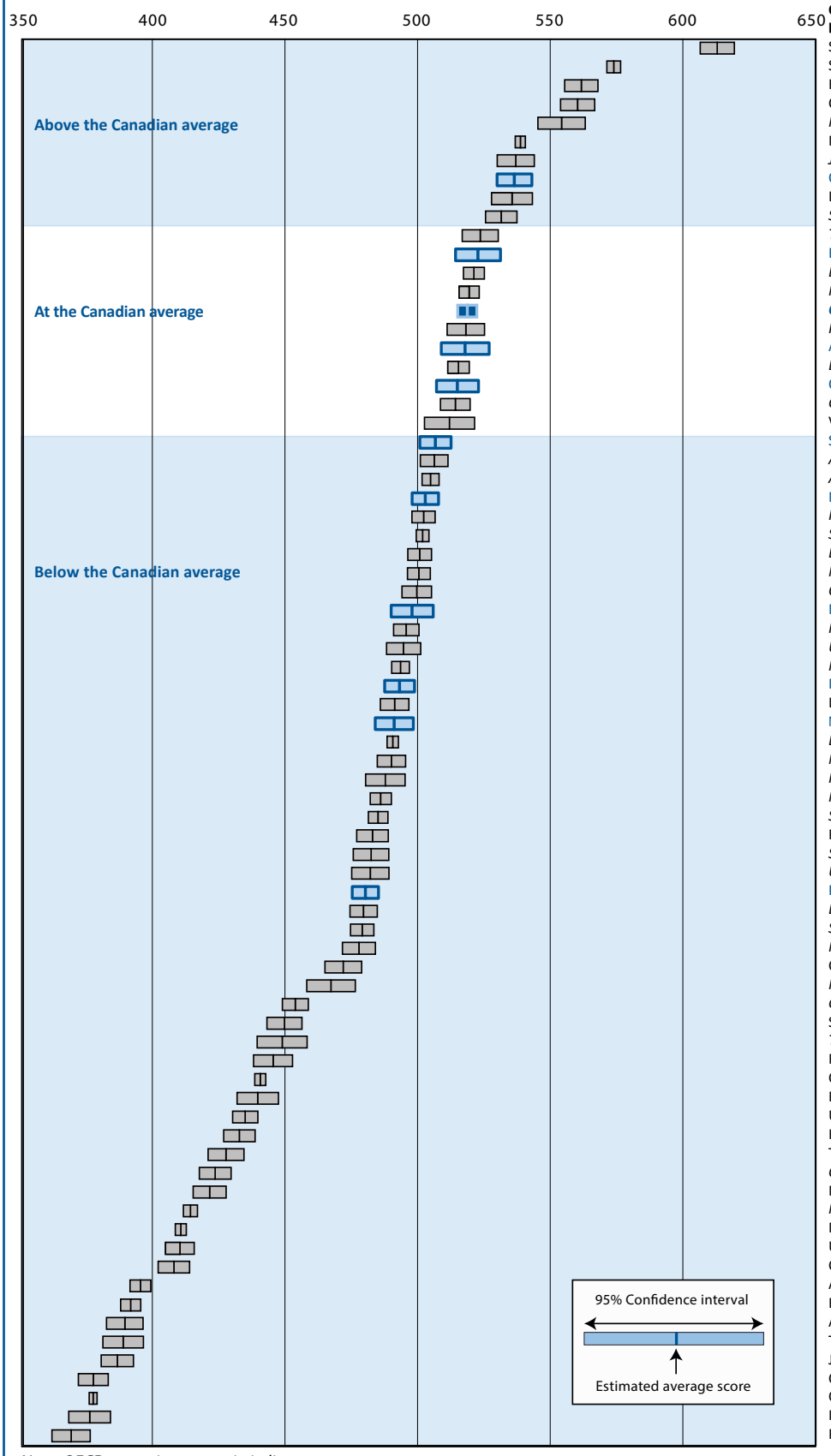
As minor domains in PISA 2012, reading, science, and problem solving were only measured at an overall, rather than detailed, level. Canada did not participate in the financial literacy option.

For the mathematics and reading components, the assessment was delivered in two formats: paper-and-pencil and computer-based. 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.

Sixty-five countries participated in PISA 2012, including all 34 OECD countries. Between 5,000 and 10,000 students aged 15 from at least 150 schools were typically tested in each country. In Canada, approximately 21,000 15-year-olds from about 900 schools participated across the ten provinces.

Canada continues to perform well in mathematics

Estimated average scores and confidence intervals for countries and provinces: PAPER-BASED MATHEMATICS



Countries and provinces	Average	S.E.
Shanghai-China	613	3.3
Singapore	573	1.3
Hong Kong-China	561	3.2
Chinese Taipei	560	3.3
Korea	554	4.6
Macao-China	538	1.0
Japan	536	3.6
Quebec	536	3.4
Liechtenstein	535	4.0
Switzerland	531	3.0
The Netherlands	523	3.5
British Columbia	522	4.4
Estonia	521	2.0
Finland	519	1.9
Canada	518	1.8
Poland	518	3.6
Alberta	517	4.6
Belgium	515	2.1
Ontario	514	4.1
Germany	514	2.9
Vietnam	511	4.8
Saskatchewan	506	3.0
Austria	506	2.7
Australia	504	1.6
New Brunswick	502	2.6
Ireland	501	2.2
Slovenia	501	1.2
Denmark	500	2.3
New Zealand	500	2.2
Czech Republic	499	2.9
Nova Scotia	497	4.1
France	495	2.5
United Kingdom	494	3.3
Iceland	493	1.7
Manitoba	492	2.9
Latvia	491	2.8
Newfoundland and Labrador	490	3.7
Luxembourg	490	1.1
Norway	489	2.7
Portugal	487	3.8
Italy	485	2.0
Spain	484	1.9
Russian Federation	482	3.0
Slovak Republic	482	3.4
United States	481	3.6
Prince Edward Island	479	2.5
Lithuania	479	2.6
Sweden	478	2.3
Hungary	477	3.2
Croatia	471	3.5
Israel	466	4.7
Greece	453	2.5
Serbia	449	3.4
Turkey	448	4.8
Romania	445	3.8
Cyprus	440	1.1
Bulgaria	439	4.0
United Arab Emirates	434	2.4
Kazakhstan	432	3.0
Thailand	427	3.4
Chile	423	3.1
Malaysia	421	3.2
Mexico	413	1.4
Montenegro	410	1.1
Uruguay	409	2.8
Costa Rica	407	3.0
Albania	394	2.0
Brazil	391	2.1
Argentina	388	3.5
Tunisia	388	3.9
Jordan	386	3.1
Colombia	376	2.9
Qatar	376	0.8
Indonesia	375	4.0
Peru	368	3.7

Note: OECD countries appear in italics.
The OECD average is 494, with a standard error of 0.5.

A PISA innovation: the computer-based assessment of mathematics

In 2012, PISA included for the first time an optional assessment of mathematical literacy that was administered on a computer. This assessment made use of enhancements offered by computer technology to present more engaging questions and new item formats, which in turn required students to provide a wider array of answers.

Among the 32 countries that participated in this optional component, Canada performed well overall, being surpassed by only seven countries: Singapore, Shanghai-China, Korea, Hong Kong-China, Macao-China, Japan, and Chinese Taipei.

At the provincial level, the computer-based assessment reveals some interesting results when compared with the paper-based component. Students in Quebec, Ontario, Alberta, and British Columbia performed at the Canadian average, while those in the remaining provinces were below the Canadian average.

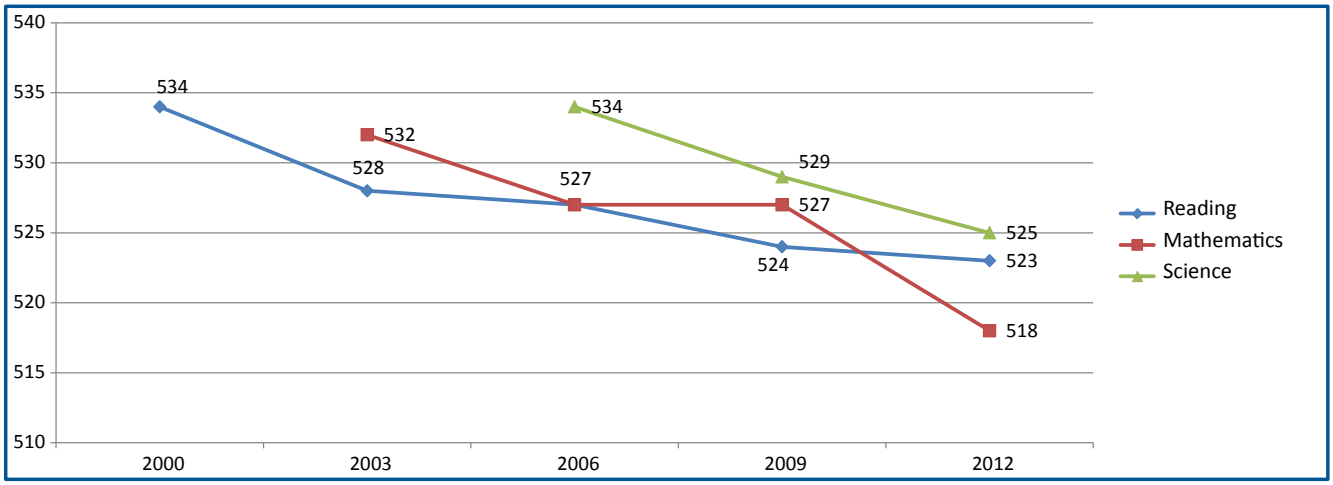
Over the past nine years, the Canadian scores in mathematics have declined

The performance of Canadian 15-year-olds has significantly declined between the 2003 and 2012 PISA cycles. Mathematics scores decreased in all provinces except Quebec and Saskatchewan, where the changes were not statistically significant over the nine-year span. The largest declines occurred in Manitoba, Alberta, and Newfoundland and Labrador.

Canadian students' performance in reading remained relatively stable over time, while performance in science decreased

Canadian students continue to perform well internationally in both reading and science, scoring well above the OECD average. Among the 65 countries that participated in PISA 2012, five outperformed Canada in reading while seven outperformed Canada in science. Canada's average score in reading decreased from 2000 to 2012, but this decrease was not statistically significant. The decrease in science performance was statistically significant between 2006 and 2012. Overall, although Canada continues to perform well in both reading and science, its international standing among PISA participants has slipped.

PISA – Canadian results over time, 2000-2012
Reading, Mathematics and Science



Canada continues to perform well in both reading and science

	Countries and provinces performing significantly better than Canada	Countries and provinces performing the same as Canada
Reading	Shanghai-China, Hong Kong-China, Singapore, Japan, Korea, **British Columbia**	**Ontario**, **Alberta**, Finland, Ireland, Chinese Taipei, **Quebec**, Poland, Liechtenstein
Science	Shanghai-China, Hong Kong-China, Singapore, Japan, Finland, **British Columbia**, Estonia, **Alberta**, Korea	Vietnam, **Ontario**, Poland, Liechtenstein, Germany, Chinese Taipei, the Netherlands, Ireland, Australia

Across Canada, mathematics results show some differences by language of the school system

PISA 2012 also examined the performance of students in English and French school systems for those Canadian provinces that sampled these population groups separately and where the sample was sufficiently large to allow for separate reporting. PISA performance was compared for students in the anglophone school system and those in the francophone system for seven Canadian provinces: Nova Scotia, New Brunswick, Quebec, Ontario, Manitoba, Alberta, and British Columbia.

Given the mathematics results in the province of Quebec, it is not surprising to see that for Canada overall, the average of students in the francophone school systems is higher than for students in the anglophone systems. Only two provinces (Quebec and Ontario) showed a statistically different performance on the mathematics scale between the two systems. Students from the francophone system in Quebec and from the anglophone system in Ontario achieved a higher average than their peers in the same province. In reading and science, students attending majority-language school systems outperformed those in minority-language systems in most Canadian provinces.

In Canada and in most other countries, boys perform better than girls in mathematics

As with previous PISA cycles, boys continue to outperform girls in mathematics across most participating countries, including Canada. It is worth noting that across provinces, differences between boys and girls are statistically significant in overall mathematics in four provinces only (Quebec, Ontario, Alberta, and British Columbia). For Canada as a whole, the gender difference is statistically significant for all three processes and all content areas, with larger differences in favour of boys observed in *Formulating* and in *Change and Relationships.*

Conversely, girls performed significantly better than boys in PISA 2012 on the reading test in all countries and provinces. In science, no statistically significant gender differences were observed in Canada or any of the provinces.

Summary of gender differences, Canada and the provinces

	Boys performed significantly higher than girls	Girls performed significantly higher than boys	No significant difference between boys and girls
Mathematics	**Canada**, Quebec, Ontario, Alberta, and British Columbia		Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, and Saskatchewan
Reading		**Canada and all provinces**	
Science			**Canada and all provinces**

Looking forward

Results from PISA 2012 confirm the success of our education systems from a global perspective: Canada remains in a small group of top-performing countries, and achieves high performance combined with mostly equitable outcomes. However, the trend in decreasing average scores noted in past PISA cycles is confirmed in 2012. Indeed, results from PISA, as well as from other pan-Canadian and international assessments, show that several provinces have experienced a significant decline in the skill levels of their youth over the past decade. This decline is perhaps a strong signal for ministries and departments of education, as well as for education partners, to work together in validating current education policies, learning outcomes, and teaching approaches and strategies, as well as allocating resources to ensure that they continue meeting the needs of our society.

Further Canadian results are available in the report, **Measuring up: Canadian Results of the OECD PISA Study – The Performance of Canada's Youth in Mathematics, Reading and Science – PISA 2012 First Results for Canadians Aged 15**.

This publication is available electronically without charge, through the internet at:

www.pisa.gc.ca www.cmec.ca