Measuring up: Canadian Results of the OECD PISA Study

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

2003 First Findings for Canadians Aged 15

Highlights

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Statistics Canada

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Canada

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Highlights

Canadian 15-year-olds perform well in mathematics

Among the 41 participating countries, students from only two countries (Hong Kong-China and Finland) outperformed Canadian 15-year-olds in mathematics. While all provinces performed at or above the OECD average in mathematics overall, there were some notable provincial differences. Students in Alberta, British Columbia, and Quebec performed as well as those from the top performing countries. The performance of students from Alberta was above the Canadian average. Students from Newfoundland and Labrador, Prince Edward Island, New Brunswick, Nova Scotia, and Saskatchewan performed below the Canadian average.

In the mathematics subdomains of *change and relationships, quantity, and uncertainty* (see text box *What is PISA* for definitions), only one or two countries had higher average scores than Canada. In the sub-domain of *space and shape,* students in eight countries outperformed Canadian students. This suggests that Canada's relative weakness lies in *space and shape*.

The performance of Canadian 15-year-olds in *space and shape* did not change between PISA 2000 and 2003, whereas performance increased in *change and relationships.* Comparisons between PISA 2000 and 2003 in *quantity* and *uncertainty* cannot be made as these sub-domains were not measured in the PISA 2000 assessment.

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. It assesses youth outcomes in three domains – reading, mathematics and science – 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 with each cycle providing detailed assessment in one of the three domains and summary assessments in the other two. In PISA 2003, mathematics was the major assessment domain and it included four content areas also referred to as sub-domains:

- *Space and shape* involves mathematical skills required to study shapes and forms and to understand and represent the relative positions of objects and relates most closely to geometry.
- *Change and relationships* involves the ability to model or measure patterns of change and growth and relates most closely to algebra.
- *Quantity* focuses on the ability to understand size, recognize patterns, and generally use numbers to count and measure objects and their characteristics.
- *Uncertainty* involves mathematical skills related to statistics and the understanding of probability and chance.

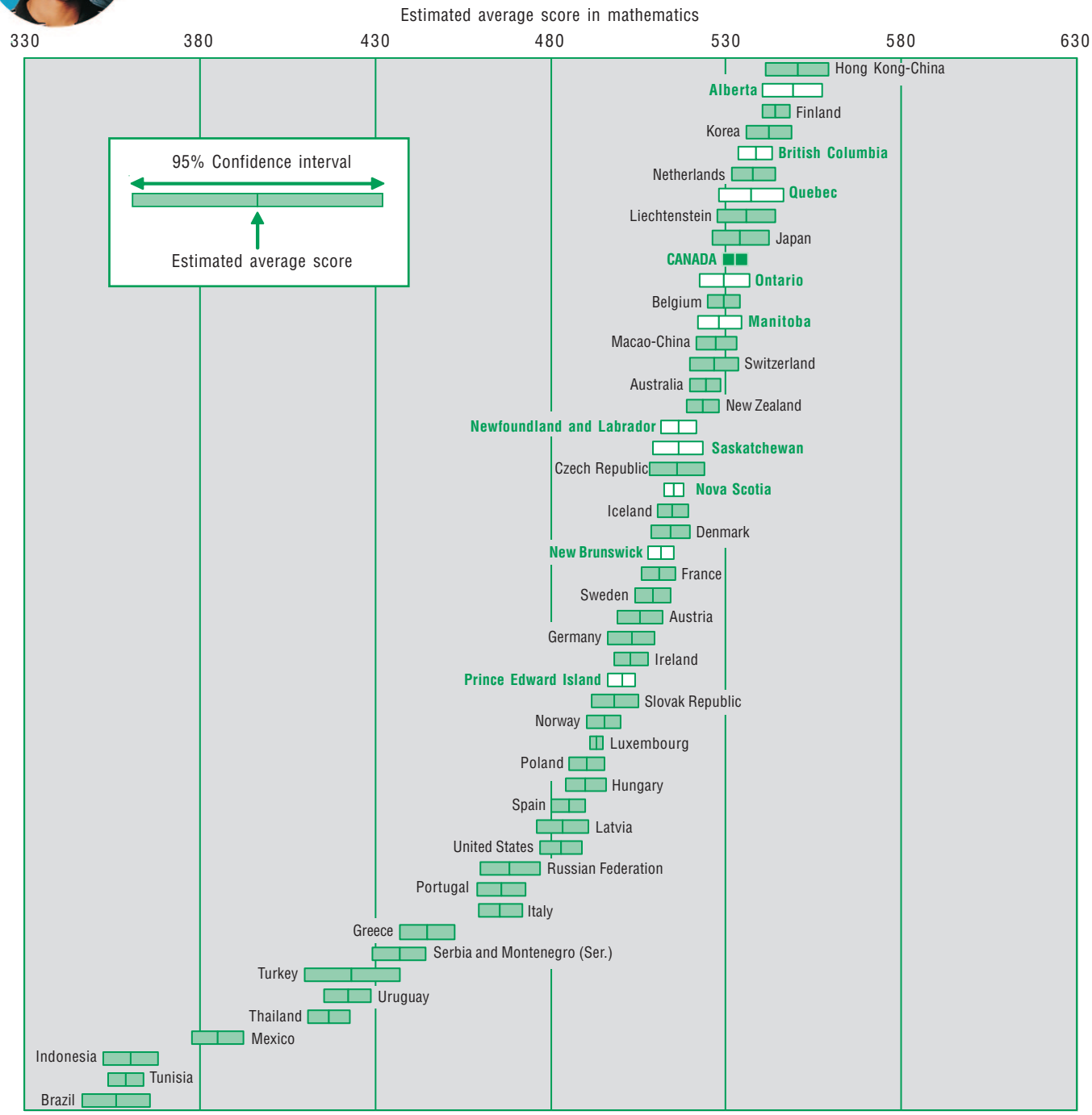
In addition to reading and science, PISA 2003 included a third minor domain – problem-solving skills.

Forty-one countries[1] participated in PISA 2003, including all 30 OECD countries. In Canada, about 28,000 15-year-old students from over 1,000 schools participated. A large sample was drawn in Canada so that information could be provided at both national and provincial levels[2].

The PISA 2003 included a direct assessment of students' skills, a student questionnaire, and a school questionnaire completed by principals. In Canada, students completed a supplementary questionnaire that gathered information about their school experiences, work activities, and relationships with others; and parents responded to a telephone survey.

1. Although the United Kingdom participated in PISA 2003, technical problems with its sample prevent its performance results from being presented.
2. No data were collected in the three territories nor on Indian Reserves.

Students from only two countries outperformed Canadian students in mathematics



Note: The confidence interval represents the range within which the score for the population is likely to fall 95% of the time or 19 times out of 20. Differences in average scores between two jurisdictions are not statistically significant when the confidence interval for each average score overlaps. For example, countries performing about the same as Canada have a confidence interval for the average score that overlaps with Canada's confidence interval. The OECD average is 500 with a standard error of 0.6.

Between 2000 and 2003, Canadian students' performance was unchanged in reading but lower in science

Canadian 15-year-olds also performed well in the other domains measured by PISA. Only Finland outperformed Canada in reading while four countries had higher average scores in science and problem solving (Finland, Japan, Hong Kong-China, and Korea).

All provinces performed at or above the OECD average in reading, science, and problem solving with one exception: Prince Edward Island performed below the OECD average in science. Students in Alberta performed as well as those in the top performing countries and were above the Canadian average in reading, science, and problem solving. Students in Prince Edward Island, New Brunswick, Nova Scotia, and Saskatchewan performed below the Canadian average in all three domains, while students in Newfoundland and Labrador performed below the Canadian average in problem solving.

Nationally, the reading performance of 15-year-olds remained unchanged between 2000 and 2003. This was true in all provinces except Prince Edward Island and Saskatchewan where reading performance decreased. Despite performing well internationally, the average performance of Canadian 15-year-olds in science decreased between 2000 and 2003. This decrease was statistically significant in three provinces (Prince Edward Island, Quebec, and Saskatchewan). The next PISA assessment in 2006, focusing on science, will provide a more definitive profile of Canada's performance in this domain.

Boys do slightly better than girls in mathematics but girls do much better in reading

In Canada, as well as in a majority of countries, boys out-performed girls in mathematics, but the difference was relatively small. Furthermore, there was no difference between girls and boys in three provinces (Prince Edward Island, Quebec, and Saskatchewan). On the other hand, as was the case in PISA 2000, there was a relatively large difference favouring girls in reading in the vast majority of countries and in all Canadian provinces.

As was the case with mathematics, boys performed better than girls in science in Canada overall. However, among the provinces, the difference was significant in Manitoba, Nova Scotia and Ontario. Finally, there was no gender difference in problem solving in Canada nor in any province except for Prince Edward Island and Saskatchewan, where girls out-performed boys.

The performance of students in minority language school systems varies across domains

There was no difference in mathematics performance between students in the English-language and French-language school systems[1] except for Ontario. In Ontario, the average performance of students in the French-language school system was below that of their peers in the English-language school system in mathematics, reading, science, and problem solving.

The performance of students in the French-language school systems in New-Brunswick and Nova Scotia was lower in reading, science, and problem solving. In Manitoba, students from the French-language school system had lower performance in reading and science.

In Quebec, there was no difference between the French-language and English-language school systems in any of the domains assessed.

Mathematics confidence and anxiety are strongly related to achievement

Mathematics self-confidence (i.e., one's feelings of confidence about being able to solve specific mathematical problems) and mathematics anxiety are strongly associated with mathematics performance. Students with high levels of mathematics confidence performed much higher (133 score points) than did students with low levels. Furthermore, students with a high level of mathematics anxiety (i.e., one's feelings of helplessness and emotional stress when dealing with mathematics) performed 71 score points lower than students with less anxiety. These findings suggest that high self-confidence and low mathematics anxiety may be important outcomes on their own.

The impact of family socio-economic status on mathematics achievement is smaller in Canada

Canadian students tend to be more advantaged in their socio-economic status (SES) than students in OECD countries combined, but students in some provinces are more advantaged than others.

Students from only one country outperform Canadian students in reading; students from only four countries outperform Canadian students in science and problem solving

	Countries and provinces performing significantly better* than Canada	Countries and provinces performing the same* as Canada
Reading	Finland, Alberta	British Columbia, Korea, Ontario, Quebec, Australia, Liechtenstein, New Zealand, Newfoundland and Labrador, Manitoba
Science	Finland, Japan, Hong Kong-China, Alberta, Korea	British Columbia, Liechtenstein, Australia, Macao-China, Netherlands, Czech Republic, New Zealand, Quebec, Ontario, Newfoundland and Labrador, Switzerland, Manitoba, France
Problem Solving	Korea, Hong Kong-China, Finland, Japan, Alberta	British Columbia, New Zealand, Macao-China, Quebec, Australia, Liechtenstein, Ontario, Manitoba, Belgium, Switzerland, Netherlands

* Differences in scores are statistically significant only when confidence intervals do not overlap. Countries performing about the same as Canada have a confidence interval that overlaps that of Canada.

Estimated average score in mathematics and reading by gender, Canada and the provinces

	Estimated average score		Difference (M - F)[1]			Estimated average score		Difference (M - F)[1]	
	Females	Males	Score difference	(SE)		Females	Males	Score difference	(SE)
Mathematics-combined					**Reading**				
Newfoundland and Labrador	512	522	**10**	(4.2)	Newfoundland and Labrador	538	503	**-34**	(4.9)
Prince Edward Island	501	500	-1	(4.5)	Prince Edward Island	517	469	**-48**	(4.8)
Nova Scotia	509	521	**11**	(3.9)	Nova Scotia	529	497	**-32**	(4.5)
New Brunswick	509	515	**6**	(2.9)	New Brunswick	523	483	**-40**	(3.0)
Quebec	534	541	7	(4.6)	Quebec	542	508	**-34**	(4.6)
Ontario	524	536	**11**	(4.0)	Ontario	542	517	**-25**	(4.1)
Manitoba	521	535	**14**	(5.0)	Manitoba	535	505	**-29**	(5.1)
Saskatchewan	518	515	-3	(3.7)	Saskatchewan	535	489	**-46**	(3.8)
Alberta	544	554	**10**	(4.4)	Alberta	559	527	**-33**	(4.5)
British Columbia	534	542	**8**	(3.2)	British Columbia	551	519	**-32**	(3.7)
Canada	530	541	**11**	(2.1)	Canada	546	514	**-32**	(2.0)

* Significant differences are marked in bold. Difference is significant when the score difference +/- (1.96*SE) does not include zero.

In every province, students with higher SES (that is, those whose parents had higher occupational status and education, and more resources at home) tended to have higher performance in mathematics. However, differences in the performance of students with different levels of SES were less pronounced for Canada than they were for all OECD countries combined suggesting that the impact of family socio-economic status on mathematics achievement is smaller in Canada.

The socio-economic composition of schools influences mathematics achievement

Fifteen-year-olds who attended schools with students from higher SES backgrounds performed better in mathematics regardless of the SES of their family. This suggests that students are not only affected by the socio-economic circumstances of their own parents, but by those of their school peers as well. Socio-economic status, however, cannot explain all the differences in student performance. Even if all students and schools had similar socio-economic status, there would still be differences in student performance.

Looking forward

There are differences in performance in Canada between students of different backgrounds and among provinces. These differences warrant further reflection in order to understand how all youth can develop their knowledge and skills to maximum potential. However, the performance of Canadian 15-year-olds in an international context is promising to their future and the future of Canada.

Notes

1. This information is available for the five provinces (Nova Scotia, New Brunswick, Quebec, Ontario, and Manitoba) that sampled these population groups separately.

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, Science and Problem Solving – 2003 First Findings for Canadians Aged 15*. This publication is available electronically without charge, through the internet at:

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