

Measuring Up: Canadian Results of the OECD PISA 2022 Study

The Performance of Canadian 15-Year-Olds in Mathematics,
Reading, and Science

Highlights



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Canada 

Highlights



Canadian results in mathematics in international context

Canada has maintained a respectable level of performance in mathematics, with 78 percent of Canadian 15-year-old participants in PISA reaching the baseline level of mathematics proficiency required to participate fully in modern society (Level 2), compared to 69 percent of students across OECD countries. Inversely, 22 percent of Canadian students did not reach Level 2 in mathematics, compared to the OECD average of 31 percent. More than 60 countries had a higher proportion of students performing below Level 2 compared to Canada. At the higher end of the mathematics scale, 12 percent of Canadian students attained the highest levels of proficiency (Levels 5 or 6), compared to 9 percent across OECD countries.

Canadian students achieved a mean score of 497 in mathematics, which is 25 points above the OECD average. Canada was outperformed by eight countries:¹ Singapore, Macao (China), Chinese Taipei, Hong Kong (China), Japan, Korea, Estonia, and Switzerland. Students in Canada overall performed as well as students in the Netherlands. Canadian students achieved strong results in each of the four mathematics process subscales reported on by PISA, as well as in the four content knowledge subscales. Indeed, Canadian averages were above OECD averages across all subscales (see the box “What is PISA?” for definitions of the subscales).

Provincial results in mathematics

Across the provinces, the percentage of Canadian students at or above the baseline level of performance ranged from 66 percent in Newfoundland and Labrador to 83 percent in Quebec. At the higher end of the PISA mathematics proficiency scale, 15 percent or more of students in Quebec and Alberta achieved at Level 5 or higher.

With respect to achievement scores, four provinces performed above the OECD average. When compared to the results for Canada overall, Quebec students achieved average scores that were above the Canadian average, while students in Ontario, Alberta, and British Columbia achieved scores that were at the Canadian average. Students in six provinces (Newfoundland and Labrador, Prince Edward Island, Nova Scotia, New Brunswick, Manitoba, and Saskatchewan) scored below the Canadian average. There was also variation across the provinces on the process and content knowledge subscales: students in Quebec scored above the Canadian average on all of the subscales, while students in Alberta scored above the Canadian average on one subscale. Students in all other provinces scored at or below the Canadian average on all the subscales.

¹ In this report, the word *countries* is used to denote countries and economies.

Equity in Canada

The gap that exists between students with the highest and lowest levels of performance is a valuable indicator of the equity of education outcomes. For Canada overall, those in the highest decile scored an average of 244 points higher in mathematics than those in the lowest decile, which is similar to the gap across OECD countries. At the provincial level, the smallest gaps (i.e., greater equity) were in Newfoundland and Labrador, Prince Edward Island, Manitoba, and Saskatchewan, while the largest gaps (i.e., less equity) were observed in Alberta.

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 measure the skills and knowledge of 15-year-old students. Data gathered through PISA allow for a thorough comparative analysis of the performance of students near the end of their compulsory education. In addition to student performance data, the contextual data collected as part of the assessment provide insight into the ways in which achievement varies across different social and economic groups, within and among countries. As a result, PISA provides policy-oriented international indicators to shed light on a range of factors that contribute to successful students, schools, education systems, and learning environments. In Canada, PISA is carried out through a partnership between Employment and Social Development Canada (ESDC) and the Council of Ministers of Education, Canada (CMEC).

The assessment has been conducted every three years since 2000 (due to the global pandemic, the cycle scheduled for 2021 was delayed by a year). PISA assesses mathematical, reading, and scientific literacy and provides a more detailed look at one of those domains in the years when it is the major focus. The major focus of PISA 2022 was mathematics, while reading and science were tested as minor domains, with creative thinking as an innovative domain and financial literacy as an optional minor domain. As part of the assessment, students and their school principals completed questionnaires that are designed to provide contextual information to aid in the interpretation of the performance results.

Eighty-one countries participated in PISA 2022. Typically, between 5,000 and 10,000 15-year-old students from at least 150 schools were tested in each country. In Canada, approximately 23,000 students from over 850 schools participated across the 10 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, Saskatchewan, Alberta, and British Columbia. The assessment was administered in English and in French, depending on the school system in which students were enrolled.

PISA 2022 adopted a multi-stage adaptive testing approach for the computer-based assessment of mathematics (CBAM). As in PISA 2018, the assessment also used a multi-stage adaptive testing approach for reading, while a non-adaptive testing approach was used for science. The distinction between the coverage of the major domain and the two minor domains has been less prominent in the last two PISA cycles than in previous administrations. As in 2018, the test design in 2022 provided full coverage of the constructs for all three domains, with approximately one-half of the total testing time dedicated to the major domain.

The PISA 2022 mathematics domain consists of a total of eight subscales: a mathematical reasoning subscale, three subscales for mathematical problem solving, and four content knowledge subscales.

The mathematical reasoning and mathematical problem-solving subscales consist of:

- *mathematical reasoning*, which refers to “thinking mathematically” and is the capacity to use mathematical concepts, tools, and logic to conceptualize and create solutions to real-life problems and situations;

- *formulating situations mathematically*, which refers to the ability to recognize or identify the mathematical concepts and ideas underlying real-world problems and to then provide mathematical structure to the problems;
- *employing mathematical concepts, facts, procedures*, which refers to the ability to apply appropriate mathematics tools to solve mathematically formulated problems in order to obtain mathematical conclusions; and
- *interpreting, applying, and evaluating mathematical outcomes*, which refers to the ability to reflect on mathematical solutions, results, or conclusions and interpret them in the context of real-life problems.

The content knowledge subscales consist of:

- *change and relationships*, which involves understanding fundamental types of change and recognizing when they occur in order to use suitable mathematical models to describe and predict change. Mathematically, this means modelling the change and the relationships with appropriate functions and equations, as well as creating, interpreting, and translating among symbolic and graphical representations of relationships;
- *quantity*, which incorporates the quantification of attributes of objects, relationships, situations, and entities in the world; understanding various representations of those quantifications; and judging interpretations and arguments based on quantity. To engage with the quantification of the world involves understanding measurements, counts, magnitudes, units, indicators, relative size, and numerical trends and patterns;
- *space and shape*, which encompasses a wide range of phenomena that are encountered everywhere in our visual and physical world: patterns, properties of objects, positions and orientations, representations of objects, decoding and encoding of visual information, and navigation and dynamic interaction with real shapes as well as with representations; and
- *uncertainty and data*, which includes 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. It also includes forming, interpreting, and evaluating conclusions drawn in situations where uncertainty is central. Quantification is a primary method for describing and measuring a vast set of attributes of aspects of the world.

Results in reading and science

In reading, 82 percent of Canadian students and 74 percent of students in OECD countries performed at or above Level 2, the baseline level of performance. This means that 18 percent of Canadian students did not reach the baseline level in reading, compared to an average of 26 percent across OECD countries. At the higher end of the scale, 14 percent of students in Canada overall performed at Level 5 or above, compared to an average of 7 percent across OECD countries.

In science, 85 percent of Canadian students and 76 percent of students in OECD countries performed at or above Level 2. In contrast, 15 percent of Canadian students did not reach the baseline level in science, compared to 24 percent of students on average across the OECD. At the higher end of the science achievement scale, 12 percent of Canadian students performed at Level 5 or above, compared to an OECD average of 7 percent.

On average, Canadian participants performed well in reading and science. Canadian students had an average score of 507 in reading and 515 in science, well above the OECD averages of 476 in reading and 485 in science. Among the 81 countries that participated in PISA 2022, five performed above Canada in reading, while six performed above Canada in science.

Provincial averages in reading and science compared to the Canadian average are presented in the table below.

Comparison of provincial averages to the Canadian average in reading and science		
Above* the Canadian average	At the Canadian average	Below* the Canadian average
Reading		
Alberta	Prince Edward Island, Quebec, Ontario, British Columbia	Newfoundland and Labrador, Nova Scotia, New Brunswick, Manitoba, Saskatchewan
Science		
Alberta	Prince Edward Island, Quebec, Ontario, British Columbia	Newfoundland and Labrador, Nova Scotia, New Brunswick, Manitoba, Saskatchewan

* Denotes significant difference.

Note: Results for Canada and most provinces (except Prince Edward Island, New Brunswick, and Saskatchewan) should be treated with caution because one or more PISA technical standards were not met (see Appendix A in *Measuring Up: Canadian Results of the OECD PISA 2022 Study* for further details).

Achievement in mathematics by language of the school system

In Canada overall, 82 percent of students in francophone school systems and 77 percent of those in anglophone school systems achieved Level 2 or above in mathematics. French-language school systems had a greater proportion of students attaining the highest levels of performance (Levels 5 and 6), as well as a lower proportion of students attaining Level 2 or lower, in comparison to their English-language counterparts.

Canadian students in French-language school systems achieved higher average scores in mathematics (511) than those in English-language systems (493). At the provincial level, Alberta students scored above the Canadian average in English-language school systems, while the scores of students in Quebec, Ontario, and British Columbia were at the Canadian English average. In French-language school systems, Quebec students scored above the Canadian French average, while Saskatchewan and Alberta students scored at the Canadian French average.

Achievement in mathematics by gender

Consistent with the results in PISA 2012, the previous administration in which mathematics was the major domain, boys performed significantly better than girls in mathematics in Canada in PISA 2022. This type of disparity is found across almost half of the countries participating in PISA 2022. A comparable proportion of girls and boys performed at Level 2 or higher in Canada overall (78 and 79 percent, respectively) and across all Canadian provinces. However, a greater proportion of boys than girls were high performers in mathematics (Levels 5 and 6) in Canada overall and in five provinces.

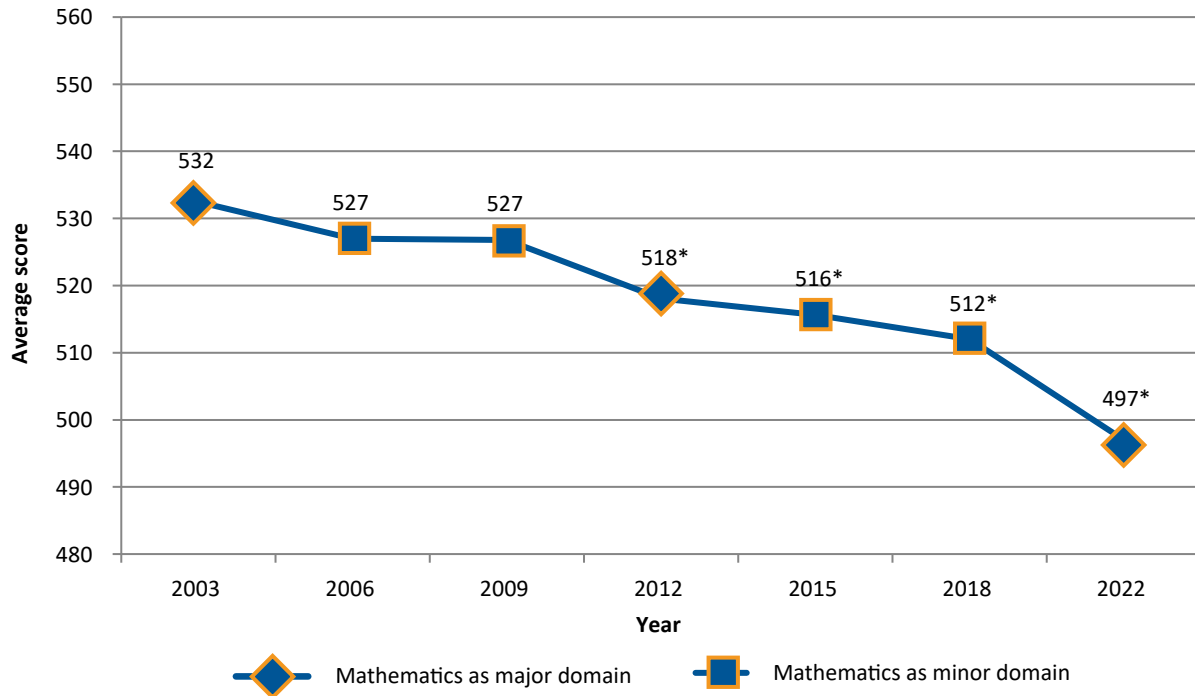
On average across Canada, boys outperformed girls by 12 points on the PISA 2022 mathematics assessment. At the provincial level, a statistically significant gender gap favouring boys ranged from 9 points in Quebec to 23 points in Prince Edward Island. Both female and male students in Quebec scored above the respective Canadian averages in mathematics, while those in Newfoundland and Labrador, Nova Scotia, New Brunswick, Manitoba, and Saskatchewan scored below the Canadian averages. In all other provinces, both genders scored at the Canadian averages except in Prince Edward Island, where girls scored below the Canadian average.

Changes in mathematics performance over time

PISA 2022 constitutes the sixth assessment of mathematics since 2003, when mathematics was first the major domain. In Canada, as well as on average across the OECD, mathematics performance declined between 2003 and 2022. At the provincial level, mathematics scores decreased in all provinces over the same period. Between 2012, the last

time mathematics was the major domain, and 2022, a decline in mathematics scores was observed in Canada, in all provinces except Prince Edward Island and Alberta, and on average across the OECD. PISA 2022 is the first PISA assessment since the COVID-19 pandemic, which disrupted school systems and students to different degrees in every country and every Canadian province. That context should be taken into account when interpreting changes in achievement over time, along with other factors that may influence such changes.

Average mathematics scores in Canada over time, 2003–2022



* Significant difference compared with baseline (2003).

Note: Results for Canada for PISA 2022 should be treated with caution because more than one PISA technical standard was not met (see Appendix A in *Measuring Up: Canadian Results of the OECD PISA 2022 Study* for further details).

At the Canadian level, the proportion of 15-year-old participants who were low performers (below Level 2) in mathematics increased between 2012 and 2022; this was also the case in all provinces except Prince Edward Island. At the same time, the proportion of students reaching the highest levels in mathematics (Levels 5 and 6) decreased in Canada overall and in Newfoundland and Labrador, New Brunswick, Quebec, Manitoba, Saskatchewan, and British Columbia.

Changes in reading and science performance over time

PISA 2022 is the eighth assessment of reading since 2000, when reading was the major domain for the first time, and the sixth assessment of science since 2006, when science was the major domain for the first time.

Between 2018 — the last time the major focus of PISA was reading — and 2022, average scores in reading declined by 13 points in Canada overall. Moreover, scores declined in every province except Prince Edward Island, Manitoba, Alberta, and British Columbia, with the largest declines in Newfoundland and Labrador (34 points), Nova Scotia (27 points), New Brunswick (20 points), and Quebec (19 points). While reading performance declined in Canada overall, this trend should be considered in the greater international context: the decline in average scores in reading in Canada is comparable to that observed on average in OECD countries. With regard to achievement levels, the proportion of low-performing students (below Level 2) increased in

Canada overall from 14 to 18 percent between 2018 and 2022. At the provincial level, the proportion of students performing below Level 2 in reading increased in Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, Ontario, and Saskatchewan.

With respect to science, scores remained unchanged between 2018 and 2022 in Canada overall and on average across OECD countries. At the provincial level, performance remained stable in most provinces except in Nova Scotia, where it declined by 16 points. However, if we compare results in 2022 with those of 2015 (the last time science was the major domain), a significant decline is evident in Canada overall and in five provinces (Newfoundland and Labrador, Nova Scotia, New Brunswick, Quebec, and British Columbia). Regarding achievement levels, the proportion of students performing below Level 2 in science increased in Canada from 13 percent to 15 percent between 2018 and 2022. At the provincial level, the proportion of students achieving below Level 2 increased only in Nova Scotia and Quebec.

Looking forward

The results of PISA 2022 reveal that Canadian students continue to perform at a respectable level in mathematics. A majority of students in Canada have attained the level of mathematics proficiency required to take advantage of further learning opportunities and to participate fully in modern society. In spite of these results, declining mathematics scores in Canada overall and all provinces since PISA 2003 suggest that there is cause for concern. For numerous students, mathematics continues to present a challenge; notably, one in five Canadian students performed at the lowest levels of proficiency (below Level 2). A persistent gender gap favouring boys also continues to exist.

Although the performance of Canadian students has declined in every domain since the last time each was the major focus of PISA (2012 for mathematics, 2015 for science, and 2018 for reading), Canada nevertheless remains in the group of top-performing countries in all three domains and achieves its standing with relatively equitable outcomes.

Further analysis of the information collected through PISA will help provide a fuller understanding of the extent to which other important contextual variables are related to the differences in performance highlighted here. Reports on such secondary analysis will be available in forthcoming issues of *Assessment Matters!*, a series of articles available on the CMEC website.

The next PISA assessment is planned for 2025, with science as the major domain and learning in the digital world as the innovative domain.

Further Canadian results are available in the report *Measuring Up: Canadian Results of the OECD PISA 2022 Study – The Performance of Canadian 15-Year-Olds in Mathematics, Reading, and Science*.

This publication is available electronically without charge, at www.cmec.ca.