What International Tests (PISA) Tell Us about Education in Canada

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Contents

Executive Summary

Canada has long maintained a high level of expenditure on education, creating and sustaining ten well-resourced provincial education systems and a highly educated workforce. Is this investment paying off? Are Canadian and provincial students attaining levels of academic performance comparable to students in other well-resourced school systems? This study draws on findings from the OECD's *Programme for International Student Assessment* (PISA) to compare the performance of Canada's Grade 10 students in the three core subjects of reading, math, and science with those in other countries.

Following an overview of PISA and other international assessment programs, the study first examines Canada's international performance, then explores interprovincial results, and finally considers the influence of socio-economic status. Special attention is given to comparing the performance of Canada's students at the national and provincial levels to students in other G7 countries, which also have well-developed and resourced school systems. Attention is given to the most recent 2018 PISA results and to those from earlier assessments to identify trends. In addition to comparing average test scores, percentages of high- and low-performing students are also considered. Extensive data displays are used to highlight major findings.

In the 2018 PISA assessment, Canadian students maintained their record as highly competitive performers, placing in the upper tier of the 78 participating countries (figure 1; Appendix A). Canadian students had their highest average scores in reading, where they outperformed students in all other G7 countries. Canadian students did least well in math, placing below the leading G7 country, Japan, and six other OECD countries, but ahead of the other G7 countries. Canada occupied a similar relative position in science, with a slightly higher average score (table 1). Canada also demonstrated a performance edge over other G7 countries in percentages of high- and low-performing students in each of the three subjects. Most notably, Canada had fewer low-performing students in all three subjects than did other G7 countries with the exception of Japan in math and science (figure 2).

Unlike other countries, Canada does not have a national education authority or a national education policy framework, so that differing provincial policies have a more direct effect on school outcomes than in other countries. Canada's four largest provinces outperformed all others in all subjects. Alberta students had the highest average scores in reading and science; Quebec students the highest scores in math. Ontario students had statistically similar reading scores to their Alberta counterparts. These three provinces scored above or close to the 95th percentile of all national and provincial scores. British Columbia scored below the other larger provinces but ahead of all other provinces. Manitoba and New Brunswick had the lowest average provincial scores in reading and science; Manitoba and Saskatchewan the lowest scores in math. Even so, New Brunswick and Manitoba outscored G7 Italy in reading and science respectively (table 2).

Even though Canada performed very well in the 2018 PISA assessment, scores have declined in all subjects over earlier assessments (figure 3). The 14 score point decline in reading since 2000 was classified by PISA as following a "flat" trajectory, as were the reading scores of four other G7 countries. Steeper declines in Canada's math and science scores were classified as "steadily negative." No other G7 country was in this category in any of the three subjects.

Scores declined in all provinces in all three subjects, but more markedly in some. The steepest declines in the Big Four provinces were in math in Alberta and British Columbia. Reading scores in Ontario and math scores in Quebec were essentially flat (figure 8). The steepest declines in the six smaller provinces were also in math, although reading and science scores in Manitoba and Saskatchewan fell steeply (Appendix B).

PISA measures socio-economic status using an index of economic, social, and cultural status (ESCS) derived from student questionnaire responses. Canada and eight provinces had a higher ESCS score than other G7 countries. New Brunswick and Manitoba recorded a lower score than the UK, but within the statistical margin of error (figure 9). Reading scores were positively correlated with ESCS scores for G7 countries and the Canadian provinces (figure 10). Canada and six provinces also had a smaller performance gap between high and low ESCS students than other G7 countries (figure 11).

PISA recognizes lower-scoring ESCS students who achieve high reading scores as "resilient." Canada has a larger share of academically resilient students than all other G7 members except the UK. Within Canada, Ontario has the highest proportion of academically resilient students, followed by Newfoundland and Labrador and Alberta. Manitoba and Saskatchewan had the smallest percentages of resilient students in Canada. Taken together with Canada's high reading scores, the high proportion of resilient students demonstrates both high levels of academic performance and education opportunity, especially in Alberta and Ontario (figure 12).

On balance, Canada is receiving good returns on its investments in education, outperforming all other G7 countries except Japan in math and science, while providing high levels of educational opportunity for less advantaged students. Yet performance is less than even across the provinces, with Alberta excelling in reading and science, and Quebec in math. Scores have nonetheless been declining over time, especially in math and especially in Manitoba and Saskatchewan, although recent declines in British Columbia and Alberta are notable. The shallower score declines in the largest provinces of Ontario and Quebec have moderated the erosion of Canada's national scores. Yet, if continued, these trends will lower Canada's currently enviable international standing.

Introduction

Education is a potent investment. Returns on investments in education enlighten and empower individuals, enrich their lives, create enhanced employability, productivity, and income, encourage health, and promote more satisfying and longer lives. In delivering these and other benefits to individuals, investments in education strengthen societies, fuel strong and adaptive economies, and stimulate invention and innovation. These returns extend over the lifetimes of the educated and spillover into successive generations, building a solid and expanding base for future growth, prosperity, and cultural enrichment. [1]

This is an old wisdom for many families, which became orthodox government policy in modern times under the banner of human capital, stimulating substantial and sustained growth in national education systems. These investments are often measured by considering inputs, such as proportion of eligible students enrolled, per-pupil expenditures, numbers of teachers, textbooks, computers, specialized staff, and so forth. Canada has performed very well on these measures over the past century. In 2018 Canada spent 5.9 percent of GDP on K-PhD education, which was the third highest level among G7 countries after the UK (6.1 percent) and USA (6.0 percent) (OECD, 2021: Table C2.1).

Level of completed education is the most direct output measure. Over the latter half of the twentieth century, growth in secondary and tertiary level graduates has been both substantial and continuous. In OECD countries, the proportion of people with at least an upper secondary education rose from an estimated average of 45 percent in the 1950s to 81 percent in the new century; those with tertiary level qualifications rose from 13 percent to 37 percent (OECD, 2011: 13). [2] Canada has performed outstandingly on this measure, with 60 percent of 24–64 year-olds having a tertiary level education in the most recent 2020 OECD data, placing Canada first among the 45 countries considered (OECD, 2021: Table A1.1).

Yet such output measures tell us nothing about the comparative quality of education provided by different national and sub-national systems. National testing programs such as our Pan-Canadian Assessment Program (PCAP) and America's much more extensive National Assessment of Educational Progress (NAEP), provide internal measures and allow provincial or state comparisons, but do not allow comparisons between national systems.

Limited but valuable measures of comparative student achievement are provided by the International Large-Scale Assessment programs (ILSAs) established by the International Association for the Evaluation of Educational Achievement (IEA) and

[1] *Education at a Glance* (OECD, 2021) provides an easily accessible source of pertinent statistics for OECD countries. UNESCO (2022) and the World Bank (2022) offer broader coverage.

[2] For the 34 OECD members in 2011. Values are estimated due to incomplete standardization of measures in earlier decades.

the Organisation for Economic Co-operation and Development (OECD). The IEA's flagship programs, [3] TIMSS (Trends in International Mathematics and Science Study) and PRILS (Progress in International Reading Literacy Study), assess pre-secondary level students. TIMSS has tested Grade 4 and 8 students every four years since 1995, when 46 countries participated. [4] In the most recent 2019 cycle, more than 600,000 students from 58 [5] countries were assessed. Over 60 countries are expected to be represented in the forthcoming 2023 cycle. PRILS has assessed reading performance by Grade 4 students every five years since 2001 when 37 countries participated, rising to 56 in 2016.

Unfortunately, not all Canadian provinces have been fully or consistently represented in these assessments, preventing full national representation. [6] In contrast, representative samples of students from all Canadian provinces have participated in each triennial administration of the OECD's Programme for International Student Assessment (PISA) since it began measuring the reading, math and science performance of 15 year-old students in 2000. Since then, the initial group of 32 participating countries expanded to 78 in the most recent 2018 assessment, [7] providing the most comprehensive set of data for examining and comparing the academic outcomes of national schooling systems currently available. Most crucially for Canada, the PISA data includes performance and contextual data for all ten provinces.

Following a brief overview of ILSA methodology, this report draws on PISA results to review selected aspects of the academic performance of Canadian 15 year-olds in both international and interprovincial contexts.

Design, Methodology, and Products

TIMSS, PIRLS, and PISA share common design features. All employ similar psychometric techniques to assess, validate, score, scale, and analyze student responses to carefully designed, field-tested, uniform test items under controlled conditions, and all make use of sophisticated two-stage sampling to first select random samples of schools in participating jurisdictions, and to then select test participants in those schools. PISA routinely refers to its test participants as "15-year-olds," but the target population is more

[3] Other ILSA programs currently administered by IEA are the International Civic and Citizenship Education Study (ICCS), the International Computer and Information Literacy Study (ICILS), the Responses to Educational Disruption Survey (REDS) and the Literary and Numeracy Assessment (LANA) [in low- and middle-income countries]. Descriptions and a list of previous studies are available on the Association's web site <https://www.iea.nl/>.

[4] 17 participated in only the Grade 8 assessment.

[5] 39 participated in only the Grade 8 assessment.

[6] Ontario and Quebec have been "benchmark participants" in all TIMSS and PRILS assessments, providing opportunities to compare their students' performance with fully participating countries and other benchmarking subnational systems. Some other provinces have participated in various cycles of these two IEA ILSA programs, but not all.

[7] The planned 2021 cycle was postponed until 2022 due to disruptions associated with COVID-19 mitigation policies.

precisely defined as full-time or part-time students between 15 years 3 months and 16 years 2 months at the time of assessment, who have completed at least 6 years of formal schooling. This target population aims to capture students toward the end of compulsory schooling in most countries, and before the start of the higher level, more specialized, education characteristic of upper secondary level schools. Structural and operational differences between national systems mean that participating students in different nations can be in different grades. 88 percent of Canadian students participating in PISA 2018 were enrolled in Grade 10 (OECD 2019a: Table I.A2.8). Target schools can be of any type, academic or vocational, public or private, large, small, rural, urban, suburban. 821 Canadian schools enrolling 22,652 students participated in PISA 2018 (OECD, 2020: Table III.A5.2). [8]

PISA adopts a more distinctly human capital orientation than the curriculum mastery approach preferred in the IEA assessments, especially TIMSS, and also by Canada's PCAP. The PISA assessments seek to gauge how well prior learning has prepared students for their future life and learning, rather than the extent to which they have mastered widely shared curriculum expectations. These differing orientations are reflected in PISA's commitment to assessing reading, math, and science literacy in the sense of "what students know and can do" (OECD, 2019), as compared to the IEA's attention to analyzing the extent to which TIMSS test items match official math and science curriculum expectations in participating jurisdictions (Mullis et al., 2020: Appendix C).

Since 2015, students in most countries have completed the PISA assessments on computers, with a paper-based version available for countries if needed. Assessments include multiple choice and open response test items. Students respond to clusters of items organized into four 30-minute blocks, with a short break after the first two blocks. Two question blocks assess the major domain of the assessment cycle, which was reading in 2018, with each of the remaining blocks assessing one of the other subject domains or an optional topic, which was global competence in 2018, elected by 17 countries, including Canada. [9] Different clusters of items are assigned to blocks so that different students respond to different combinations of items.

To facilitate comparisons, in the initial 2000 assessment item responses for each subject domain were standardized to a mean of 500 points with a standard deviation of 100 across OECD countries. Scores in subsequent assessment cycles have been calibrated to be comparable across cycles, although average scores across OECD members have fluctuated slightly around the original 500 score point mean. (OECD, 2019c: 16).

In addition to capturing student responses to test items, each of these large-scale assessments collect a wide range of contextual information through separate questionnaires completed by students, parents or caregivers, teachers, and principals. Findings are used to generate descriptive and analytical data about the social circumstances, attitudes, and classroom experiences of students, the professional preparation and views

[8] Table available online at <https://doi.org/10.1787/888934030857>.

[9] Global competence results are not considered in this report.

of teachers, and the organization, operation and resources of the schools in which they interact. PISA augments this information with complementary system-level data routinely collected by the OECD and summarized in the organization's annual *Education at a Glance* publication (OECD, 2021).

These large-scale measurement programs all have a high degree of operational and reporting transparency. Strategically placed experts in participating jurisdictions collaborate with OECD staff in item design and validation, in sampling, test administration and in the analysis and reporting of results. In Canada these and related activities are managed by the Council of Ministers of Education, Canada (CMEC), which also coordinates with participating provinces, Statistics Canada, and Employment and Social Development Canada, which provides financial support. A wide range of reports, including media releases, infographics, special topic studies, and detailed accounts of the design, administration, and findings from each administration of the ILSAs considered here are publicly available through the organizations' websites (https://www.iea.nl/, https://www.oecd.org/pisa/ and https://www.cmec.ca/). Interactive online analysis tools are also available through the IEA and OECD/PISA websites, where copies of both published and unpublished datasets can be downloaded, as can versions of the original data files.

The findings reported below are primarily based on tabulated data summaries from the OECD/PISA website.

International Performance of Canadian Students

Mean Subject Scores

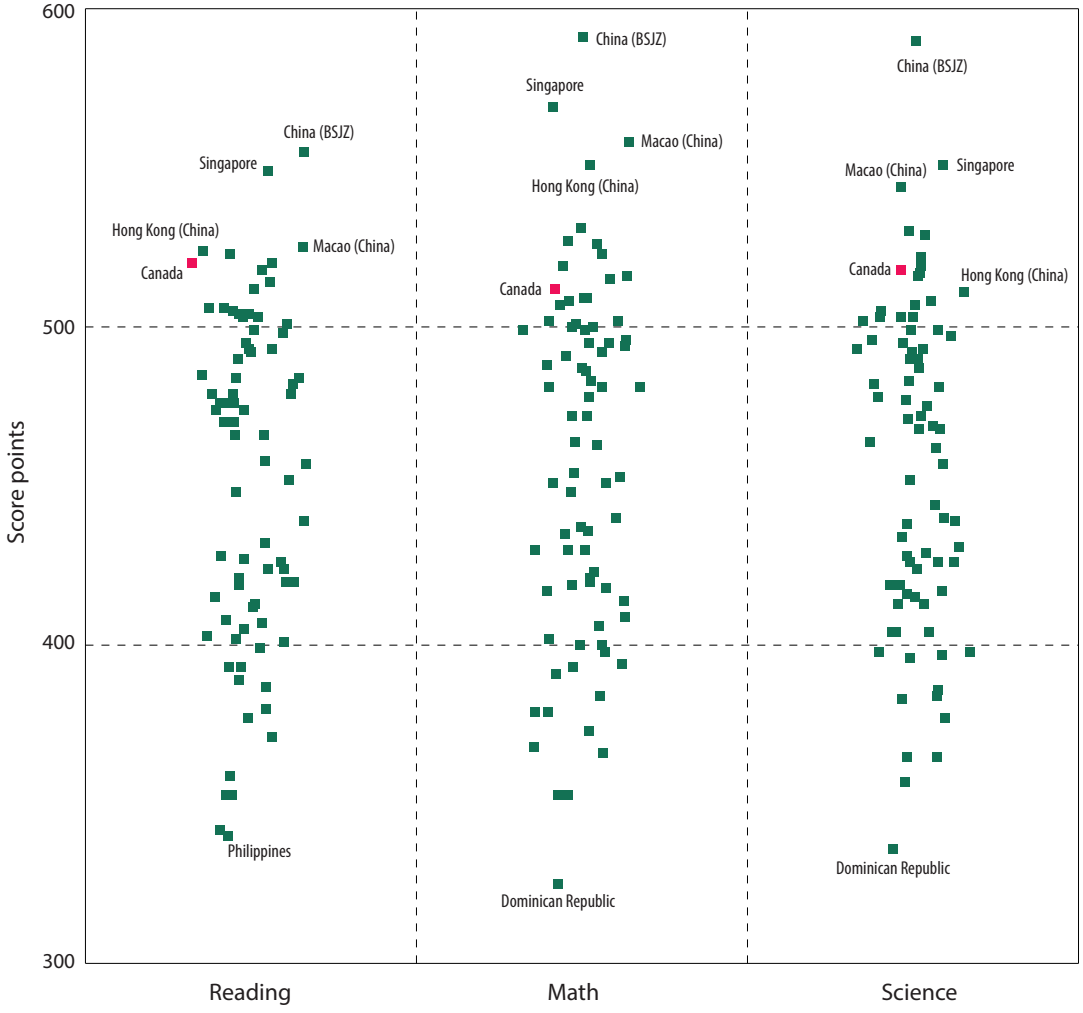
Figure 1 shows the estimated [10] mean scores in each of the three subject domains for all 78 national education systems participating in PISA 2018. The plotted values are jittered along the horizontal axis to minimize overprinting. **Appendix A** shows all participating countries ranked by the average of their three subject scores, highlighting G7 members. In each data display, Canada's scores are highlighted in red.

The math scores extend over the greatest range (266), from a maximum of 591 to a minimum of 325 score points, around a median of 468. Reading scores have the most compact distribution over a range of 216 score points from a maximum of 555 to a minimum of 339. The science scores have a similar maximum (590) to the math scores, with a slightly higher minimum (335), and thus a more compact range (255). All three distributions display some clumping of scores above and below the median, with a tighter concentration toward the upper region of their interquartile ranges, and less dense grouping in the median to 10th percentile range.

The highest scores in all three subjects appear as outliers from the main distributions. Results for the several China systems are heavily represented, China (BSJZ) having the highest scores in all three subjects, and Hong Kong (China) and Macao (China) placing prominently among the higher scoring systems. This pattern presents several problems. Having three national-level systems from the same country is both odd on its face and unique within the dataset. Schools in Hong Kong and Macao had a long, independent history prior to their current status within special administrative regions in China, raising questions about the degree to which they can be viewed as representative of education in China *per se*. Further, results for China (BSJZ), the highest scoring entity in the dataset, rely on samples of schools from only 4 of the 26 regular administrative regions in mainland China (Beijing, Shanghai, Jiangsu, and Zhejiang). Moreover, the primary and secondary schools in Beijing and Shanghai have by far the highest levels of per-pupil funding in the country, with Zhejiang also having relatively high funding (OECD, 2016: Figure 3.2).

[10] Measurements derived from any sample of a population will necessarily differ from those obtained from other samples of the same population, and thus must be accepted as estimates rather than precise measures of the true value. This sampling error can be taken into account when comparing results as discussed and illustrated below. Some degree of non-sampling error will also be present as a result of design and administrative effects.

Figure 1: Estimated PISA 2018 Mean Performance Scores for all National Systems



Source: OECD (2019a): Tables I.B1.4, I.B1.5, and I.B1.6.

For these and other reasons, the scores for these three education systems must be viewed with caution. [11]

Singapore also appears as an upper outlier in figure 1, with the second highest scores in all three subjects. This is consistent with Singapore's previous pattern of performance, which saw a steady increase in scores in all three subjects from its first participation in 2009, culminating in the highest score in each subject in 2015.

[11] Hong Kong participated in all six PISA cycles since 2000 and Macao in all five since 2003. Beijing, Shanghai, Jiangsu, and Guangdong represented mainland China in PISA 2015, Zhejiang replacing Guangdong in PISA 2018. See also Lovelace (2019).

Canada's estimated scores are in the upper range of all three distributions, ranking 6th in Reading, 8th in Science, and 12th in Math. In each case, Canada is located within groups of neighbouring countries with similar scores, so that sampling and measurement errors limit accurate differentiation.

Table 1 lists, by decreasing estimated mean scores, all national systems scoring above the 75th percentile in each of the three subject distributions plotted in figure 1, highlighting those whose scores are not statistically different from Canada's at the 95 percent level of confidence. The sampled 15-yr-old students in the national education systems not shaded can be regarded with 95 percent confidence as having achieved higher or lower average scores than their Canadian counterparts, whereas those in systems highlighted performed at levels not statistically distinguishable from Canada.

Table 1: Subject Scores and 95% CI countries above 75th percentile

Reading		Math		Science	
Score	***Country***	***Score***	***Country***	***Score***	***Country***
555.2	China (BSJZ)	591.4	China (BSJZ)	590.5	China (BSJZ)
549.5	Singapore	569.0	Singapore	550.9	Singapore
525.1	Macao (China)	557.7	Macao (China)	543.6	Macao (China)
524.4	**95th Percentile**	**551.5**	**95th Percentile**	**530.8**	**95th Percentile**
524.3	Hong Kong (China)	551.2	Hong Kong (China)	530.1	Estonia
523.0	Estonia	531.1	Tiawan (Taipei)	529.1	**Japan G7**
520.1	**Canada G7**	527.0	**Japan G7**	521.9	Finland
520.1	Finland	525.9	Korea	519.0	Korea
518.5	**90th Percentile**	**523.7**	**90th Percentile**	**518.1**	**90th Percentile**
518.1	Ireland	523.4	Estonia	518.0	**Canada G7**
514.1	Korea	519.2	Netherlands	516.7	Hong Kong (China)
511.9	Poland	515.6	Poland	515.7	Tiawan (Taipei)
505.8	Sweden	515.3	Switzerland	511.0	Poland
505.7	New Zealand	512.0	**Canada G7**	508.5	New Zealand
505.4	**United States G7**	509.4	Denmark	507.0	Slovenia
503.9	**United Kingdom G7**	508.9	Slovenia	504.7	**United Kingdom G7**
503.9	**Japan G7**	508.1	Belgium	503.4	Netherlands
502.6	Australia	507.3	Finland	503.0	**Germany G7**
502.6	Taiwan (Taipei)	502.4	Sweden	503.0	Australia
501.1	Denmark	501.8	**United Kingdom G7**	502.4	**United States G7**
499.5	Norway	501.0	Norway	499.4	Sweden
498.9	**75th Percentile**	**500.3**	**75th Percentile**	498.8	Belgium
				498.9	**75th Percentile**

Notes: Shaded cells mean scores not significantly different from Canada at the 95% confidence level.
Percentile Formula: Ave X(p[n+1]).

Source: OECD (2019a): Tables I.B1.4, I.B1.5, and I.B1.6; author's calculations.

As shown in figure 1 and table 1, Canada performed best in reading with an estimated mean score (520), higher than 90 percent of all other participating countries, but statistically similar to Hong Kong, Estonia, Finland, Ireland, and Korea. Canada performed slightly less well in science, with a score statistically lower than five other countries including Estonia, the highest scoring OECD country, and Japan, the highest scoring G7 member, but still at the 90th percentile. Canada performed least well in math, falling below the 90th percentile, and once again scoring statistically below Japan and Estonia, with an average score statistically similar to seven other countries, including Finland, which gained a reputation from earlier PISA results as having a top performing education system.

In broader perspective, Canada outperformed all G7 economies except Japan, which had significantly higher mean scores in science and math. All other G7 countries had statistically significant lower average scores in all three subjects. Germany (499), France (493), and Italy (476) all placed below the 75th percentile in the reading distribution, as did Germany (560), France (495), Italy (487) and the USA (478) in the math distribution, and France (492) and Italy (468) in the science distribution. The United Kingdom was the only other G7 country other than Canada or Japan to score above the 75th percentile in all three subjects (OECD, 2019a: Tables I.B1.4, I.B1.5, & I.B1.6).

High and Low Performers

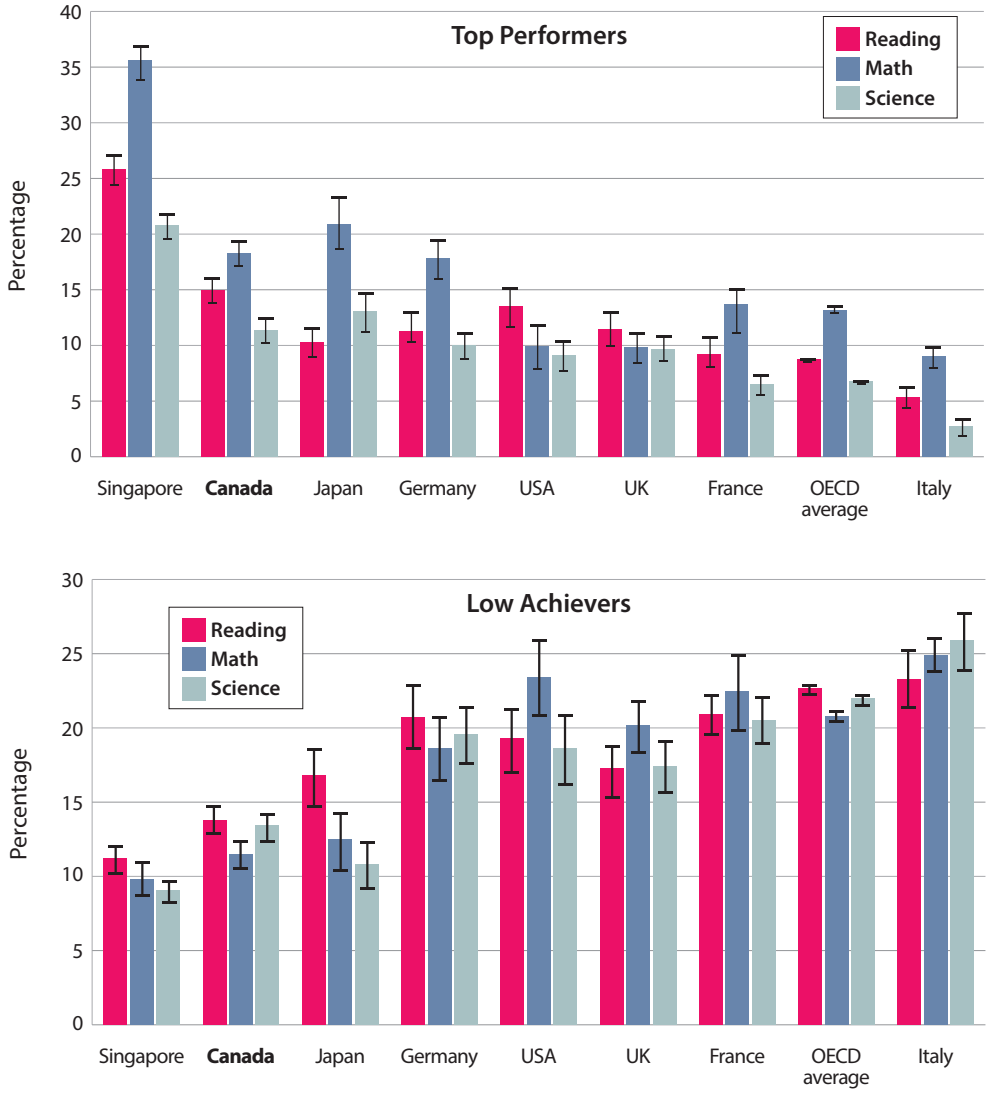
Averages are valuable for comparing performance, but are blind to higher and lower values in distributions, values which are particularly important in education. PISA addresses this by reporting the percentages of "low achievers" and "top performers" in score distributions. Top performers are defined as students performing at the highest two levels (5 or 6) on the PISA subject proficiency scales. These levels are considered to represent the multifaceted skills needed to understand and communicate the complex information characteristic of modern societies and digital technologies. [12]

The upper panel of **figure 2** charts the percentage of 2018 top performers in each subject in the G7 countries and Singapore, together with the OECD average. Jurisdictions are ranked according to the decreasing average percentage of top performers in the three subjects. The 'T' shaped error bars extending above and into the subject bars mark the boundaries of the 95 percent confidence intervals for the estimated average scores represented by those bars.

Singapore dominates the chart, with more than 25 percent of students classified as top performers in reading, 20 percent in science, and a stunning 37 percent in math. China (BSJZ) recorded even higher proportions of top performers, but has been excluded from the display because of the comparability concerns noted earlier. Several other national systems had higher percentages of top performers than the countries shown, but preference has been given to G7 countries as being those most similar to, and in more direct competition with, Canada.

[12] For full descriptions of characteristic tasks which students can perform at each proficiency level together with score ranges see OECD (2019a) Tables 1.5.1 (reading), 1.6.1 (math) and 1.7.1 (science).

Figure 2: Percentages of Top Performers and Low Achievers by Subject in G7 and Selected Comparision Systems



Source: OECD (2019a): Tables I.B1.1, I.B1.2, and I.B1.3; author's calculations.

Canada's proportion of high achievers in reading (15.0 percent) was statistically similar to the USA (13.5 percent), but significantly higher than all other G7 countries and the OECD average. Japan's notable 21 percent share of high performers in math was statistically higher than all other G7 countries, with Canada (18.3 percent) and Germany (17.8 percent) statistically tied for second place. In science, there are no statistically significant differences between the proportions of high performers in Canada, Japan, Germany, the UK, and the US, with France and Italy having significantly lower percentages at levels similar to the OECD average. Italy's comparatively meagre three percent of students qualifying as top performers in science is significantly smaller than the OECD average.

In Singapore, Canada, Japan, Germany, and France, there were significantly more students classified as top performers in math than in the other subjects. In the US there was a significantly higher percentage of top performers in reading than in math or science, and in the UK there were no subject significant differences, with about ten percent of top performers in each subject. Canada's 18 percent of top performers in math was significantly greater than the 15 percent in reading, which was itself significantly greater than the 11 percent in science. This pattern of higher proportions of math > reading > science top performers was also evident in the distribution of OECD average proportions, in three other G7 countries (Germany, France, Italy) and in Singapore, although the differences are not always statistically significant. Japan's pattern of math > science > reading proportions of top performers is unique within the systems in figure 2.

The lower panel of figure 2 charts proportions of low achievers, defined by PISA as students scoring below level 2 on the subject proficiency scales. Students scoring in the middle ranges of the proficiency scales are not reported so as to focus attention on the two tails of the performance distributions. The order of systems along the horizontal axis is the same as for the top performers in the upper panel to facilitate comparisons.

Ideally, systems will seek to maximize top performers and minimize low achievers in each subject and overall. Systems toward the left side of the data display in figure 2 are closer to this ideal, Singapore displaying the best case approximation among the systems considered. The generally increasing percentages of low achievers moving from left to right in the chart points to less desirable performance outcomes. By these standards, Canada is favourably positioned in the chart, especially in math, where the relatively small share of low achievers (11.5 percent) is significantly less than that of top performers (18.3 percent). This pattern is magnified for Japan with a marked imbalance between top performers (21 percent) and low achievers (12.5 percent) in math. This is offset by Japan's significantly higher proportion (17.0 percent) of low achievers than top performers (10.0 percent) in reading. Another significant subject disparity is the United States' 10 percent of top performers and 20 percent of low achievers in math.

With the exception of Japan, the US, and to a lesser extent the UK, where there are significant differences in the percentages of low achievers in the three subjects, the within-system subject differences among the proportions of low achievers are small and typically non-significant. Between-system differences are more marked, with Canada having statistically smaller proportions of low achievers in all subjects than all other G7 countries, with the partial exception of Japan. Whereas the average proportion of low achievers for all three subjects is below 14 percent for Singapore, Canada and Japan, it is above 18 percent for the remaining jurisdictions in figure 2, rising to 22 percent for the OECD average and 25 percent for Italy.

Comparing percentages of top performers to low achievers provides an indicator of academic productivity. Singapore, Canada and Japan are the only systems compared in figure 2 where the average percentage of top performers across the three subjects is higher than the average of low achievers. This positive ratio holds within these three

countries in math, with the difference between high and low achievers turning negative for Japan in reading, and for Canada in science.

In sum, while there are some statistically significant differences, the relative proportions of PISA 2018 top performers in reading and science in the G7 school systems are not markedly dissimilar. More substantial differences are apparent in the math scores, where Canada had statistically smaller proportions of top performing students than Japan, and was statistically tied with Germany. There is greater disparity in the proportions of low achievers, with all G7 countries having higher proportions of poor performers than Canada, except for science students in Japan. Overall, Canada enjoyed a notable edge in the proportions of G7 students who excelled and those who did poorly in the 2018 PISA assessment.

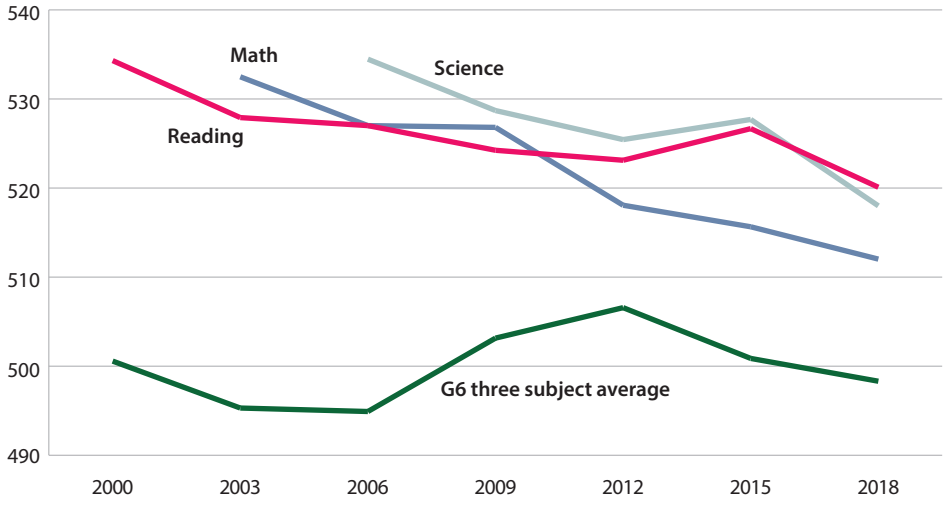
Performance Trends

Canada's performance in PISA 2018 was more than respectable—especially when compared to the other high-income countries with the well-established, extensive, and diverse education systems common among G7 members. Even so, Canada's 2018 scores were lower than in all previous PISA cycles. In the first PISA assessment in 2000, in which only 27 OECD countries participated, Canada (534) placed second behind Finland (546) in reading, with a statistically significant score difference (OECD, 2001: 53). Although PISA 2000 yielded estimated mean scores in the other two subjects, [13] accurate trend comparisons are only possible starting from the first year in which a subject was the major domain, which was 2003 for math and 2006 for science. In 2003 Canada placed 6th (532) in math, significantly behind Hong Kong (550) and Finland (544), but statistically tied with Korea (542), Netherlands (537), Liechtenstein (536) and Japan (534) (OECD, 2004: 92). In 2006, Canada ranked 3rd (534) in science, significantly behind Finland (563) and Hong Kong (563) (OECD, 2007: 56).

Since then, Canada's estimated average scores in all three subjects have declined, as traced in **figure 3**, which plots estimated average subject scores for each valid comparison assessment cycle. With the limited exceptions of the uptick in reading and science scores in 2015, and the tied math scores in 2006 and 2009, each of Canada's subject scores declined in each successive PISA cycle. In each subject, the overall decline from the starting baseline score is statistically significant at the 95 percent confidence level (Statistics Canada, 2020). Science scores suffered a decline of 16 score points between 2006 and 2018, with a sharp and statistically significant 10 score point drop from 2015 to 2018. The largest 20-point decline in estimated math scores was concentrated in the last three cycles, where scores fell 15 points from 2009 to 2018. While reading scores also declined significantly from the 2000 baseline, they levelled out between 2003 and 2015, until dropping 7 score points from 2015 to 2018 for an overall decline of 14 points. For

[13] In math, the 2000 results placed Canada 6th (533), significantly below Japan (547), Korea (547) and New Zealand (537), but statistically tied with Finland (536) and Australia (533). In science, Canada placed 5th (529), significantly lower than Korea (552) and Japan (550), but with an estimated average score statistically similar to Finland (538) and the UK (532) (OECD, 2001: 79, 88).

Figure 3: Trends in Subject Means



Sources: Statistics Canada. (2020); OECD (2019a): Tables I.B1.0, I.B1. and I.B1.2; author's calculations.

comparison, the green (bottom) line in figure 3 plots the average of the three estimated mean subject scores for "G6" countries, which is the G7 group without Canada. While Canada's scores declined overall, the average of the three subject scores in the other G7 countries remained flat, with small fluctuations.

PISA categorizes score trends into nine performance trajectories (OECD, 2019a: 130–34). Canada's overall reading performance since 2000 is classified in the "flat" trajectory category along with four other G7 countries (France, Italy, Japan, USA). Canada's score trajectories for math and science were both classified as "steadily negative." No other G7 country was classified in this category. One consequence of this pattern is a narrowing score gap between Canada and other G7 countries. In 2000, for example, there was a 30 score point difference in reading between Canada (534) and the USA (504). By 2018 the difference was reduced by half to 15 score points, which is largely attributable to the decline in Canada's score (520) while America's score (505) remained essentially unchanged. A more dramatic reduction occurred in science, where the gap between Canadian and US scores dropped from 46 score points in 2006 to 16 points in 2018, although in this case US scores also increased by 13 points while Canada's dropped by 17 points.

This pattern of decline has been accompanied by disturbing changes in the relative proportions of top performers and low achievers. Over the nine-year period from 2009 to 2018, Canada's low achievers in reading increased by a significant 3.5 percent (OECD, 2019: 224). This was the largest and only statistically significant increase among G7 countries over this period, although it was only slightly above the OECD average (3.2 percent). The achievement erosion over this period was much starker in math, where the proportion of low achievers increased by a significant 4.8 percent and the proportion of

top performers decreased by a significant 3 percent (OECD, 2019a: 230). This almost 8 percent net contraction in math performance was more than two times greater than a similar redistribution in the OECD average, and unmatched among other G7 counties. In contrast, the UK increased its top performers by a significant 3 percent. Germany and Italy suffered greater net performance redistributions in science with significant increases of 4.8 and 5.2 percent in low achievers respectively, and significant 2.8 and 3.1 percent reductions in top performers. Yet Canada was close behind, with a significant 3.9 percent increase in low achievers and a non-significant 0.8 percent decline among top performers in science.

In short, the decline in Canada's mean scores shown in figure 3 has been accompanied by significant shifts toward relatively more poorly performing students in all three subjects, with a particularly acute redistribution of students from high to low performance levels in math.

Summary

Compared to other international education systems, Canada continued to perform very well in the 2018 PISA assessment, both in terms of estimated average scores and in the balance between students classified as top performers and low achievers. On these measures Canada outperformed all other G7 countries except Japan, which had higher scores in math and science. Still, Canada is losing ground internationally with statistically significant declines in average scores in all three subjects since earlier PISA assessments. In math and science Canada is the only G7 country with steadily negative score trajectories across the last five successive assessments, a pattern of decline reflected in increasing numbers of low achievers who will likely be destined for failure, and fewer top performers, a key human capital resource in increasingly competitive future economies.

Interprovincial Performance Comparisons

Responsibility for education is typically assigned to sub-national authorities—states in the USA, the four kingdoms in the UK, Länders in Germany—with varying degrees of central control exercised through a national agency. Canada does not have such a national education authority. The federal government exercises limited influence over the provision of bilingual education through negotiated funding agreements with the provinces, and has direct responsibility for certain kinds of First Nations education, but has no constitutional authority over education in general, which is exclusively assigned to the provincial governments in the Canadian constitution. [14] The lack of a national policy presence in Canadian education places greater analytical importance on the provincial education systems than the corresponding sub-national bodies in most other countries. The performance of sub-national education systems in other countries is directly influenced to varying degrees by national policy, with a concomitant effect on national subject scores in international assessments such as PISA. In contrast, Canada's national PISA score is a product of ten different, independently organized and operated education systems, directing analytical attention to the performance of each.

Estimated Provincial Mean Scores

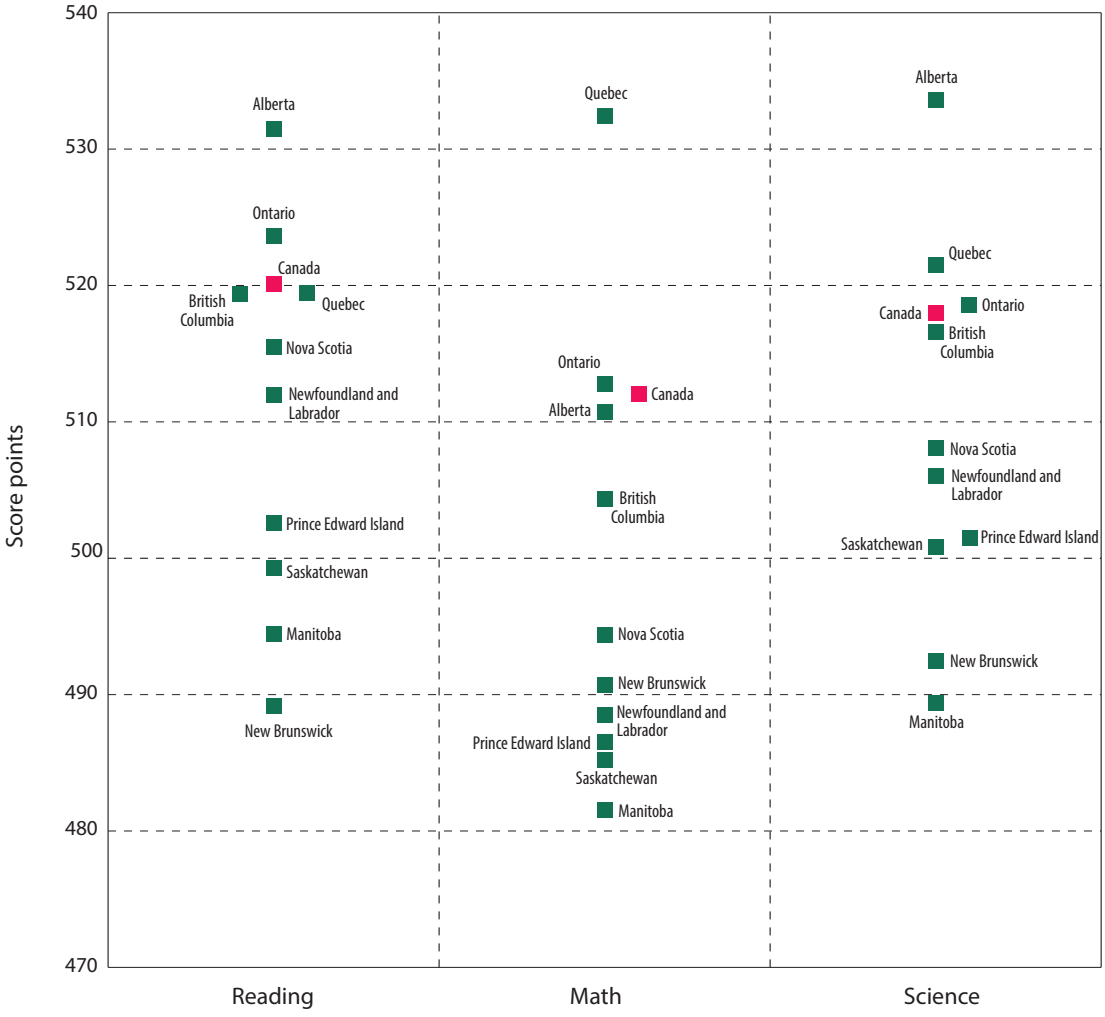
Figure 4 is a dot plot of Canada's national and provincial PISA 18 subject scores, with the national scores highlighted in red. Unlike figure 1, only a few data points have been jittered to avoid overprinting. Also unlike figure 1, the vertical axis extends over a much tighter score range, comfortably accommodating the full range of average provincial scores within a span of 70 score points, as compared to almost 300 score points in the earlier plot of all participating national systems.

As in figure 1, the plot of provincial scores shows a greater spread of scores in math, extending over a range of 51 score points, from a minimum of 482 for Manitoba, to a maximum of 533 for Quebec, around a median of 493. As was also the case with the national scores, provincial reading scores are distributed over the smallest range (42), ranging from minimum of 489 score points for New Brunswick to a maximum of 531 for Alberta, with a median of 514. Provincial science scores extend over a range of 44 score points around a median of 507 points, from a minimum of 489 points for Manitoba to a maximum of 533 points for Alberta. Also as in the national scores plotted in figure 1, the highest provincial scores in math and science are outliers from the main score distribution, especially so in math.

In addition to those outliers, the most evident feature of the score distributions in figure 2 is the presence of the same four provinces among the highest scores in each subject, although their relative positions vary. Alberta has the highest scores in reading

[14] The federal government is also responsible for education in the northern territories, but has devolved authority to local agencies.

Figure 4: Estimated PISA 2018 Mean Performance Scores for Canadian Provinces



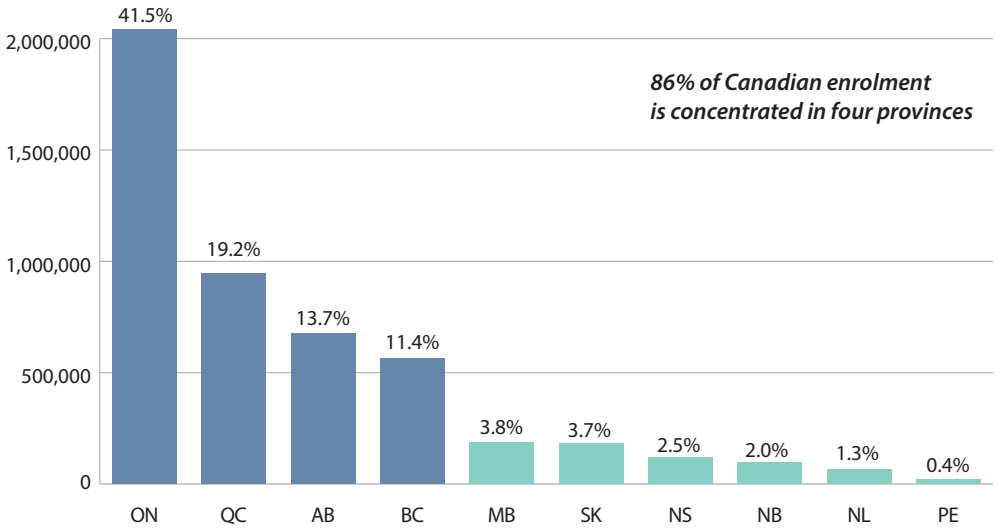
Source: OECD (2019a): Tables I.B2.9, I.B2.10, and I.B2.11.

and science, Quebec the highest score in math. Ontario occupies second place in reading and math, Quebec in science. British Columbia has the lowest scores among these four provinces in all three subjects, but only marginally so in reading.

Size Range

As shown in **figure 5**, these four provinces have by far the largest school enrolments in Canada, accounting for 86 percent of provincial elementary and secondary students, with Ontario and Quebec accounting for 60 percent of total enrolments. The remaining "Smaller Six" provinces fall into two geographic groups, the two prairie provinces of Saskatchewan and Manitoba, enrolling 7.5 percent of Canadian students, and the four Atlantic provinces, enrolling a shade over 6 percent.

Figure 5: Provincial E&S Enrolment



Source: Statistics Canada. (2021).

The dot plot in figure 4 shows the Atlantic provinces performing better than the other two smaller provinces, with the exception of New Brunswick, which ranked last among all provinces in reading, and 9th in science. Nova Scotia was a consistent high performer among the Smaller Six, ranking 5th in all three subjects. The two small prairie provinces performed least well overall, Manitoba placing last in math and science and 9th in reading; Saskatchewan ranking 9th in math and 8th in reading and science.

Apart from the similarities in size, scores and, for the Atlantic provinces, location, there are no other obvious similarities either between or within the school systems in the Big Four and Smaller Six provinces. Ontario has four distinct public systems—English public and Catholic, and French public and Catholic—as well as the largest school districts in the country, both on average and absolutely. Quebec has large French and English systems, and a unique secondary school structure terminating in the equivalent of Grade 11. In addition to its public and Catholic school districts, Alberta has the greatest variety of publicly funded school choice options in the country, including the only charter schools. British Columbia also has a high proportion of partially funded independent schools, a majority of which are Catholic under diocesan administration. Each of these provinces, as well as the education systems in smaller, lower scoring, provinces, has its own official curriculum, funding mechanism, testing programs, and teacher certification and employment regulations. In short, there are no obvious structural or operational features common to the higher and lower performing provinces.

Table 2: National and Provincial Subject Means and 95% CIs with Percentiles

Reading		Math		Science	
Score	*Country*	*Score*	*Country*	*Score*	*Country*
555.2	China (BSJZ)	591.4	China (BSJZ)	590.5	China (BSJZ)
549.5	Singapore	569.0	Singapore	550.9	Singapore
531.5	Alberta	557.7	Macao (China)	543.6	Macao (China)
525.1	Macao (China)	551.2	Hong Kong (China)	533.6	Alberta
524.8	**95th Percentile**	**542.7**	**95th Percentile**	**532.1**	**95th Percentile**
524.3	Hong Kong (China)	532.5	Quebec	530.1	Estonia
523.6	Ontario	531.1	Tiawan (Taipei)	529.1	**Japan G7**
523.0	Estonia	527.0	**Japan G7**	521.9	Finland
520.1	**Canada G7**	525.9	Korea	521.5	Quebec
520.1	**90th Percentile**	**523.7**	**90th Percentile**	**519.3**	**90th Percentile**
520.1	Finland	523.4	Estonia	519.0	Korea
519.4	Quebec	519.2	Netherlands	518.6	Ontario
519.4	British Columbia	515.6	Poland	518.0	**Canada G7**
518.1	Ireland	515.3	Switzerland	516.7	Hong Kong (China)
515.5	Nova Scotia	512.8	Ontario	516.6	British Columbia
514.1	Korea	512.0	**Canada G7**	515.7	Tiawan (Taipei)
512.0	Newf'd & Labrador	510.7	Alberta	511.0	Poland
511.9	Poland	509.4	Denmark	508.5	New Zealand
505.8	Sweden	508.9	Slovenia	508.1	Nova Scotia
505.7	New Zealand	508.1	Belgium	507.0	Slovenia
505.4	**United States G7**	507.3	Finland	506.0	Newf'd & Labrador
503.9	**United Kingdom G7**	504.3	British Columbia	504.7	**United Kingdom G7**
503.9	**Japan G7**	502.4	Sweden	503.4	Netherlands
502.6	Australia	501.8	**United Kingdom G7**	503.0	**Germany G7**
502.6	**75th Percentile**	**501.6**	**75th Percentile**	**503.0**	**75th Percentile**
502.6	Taiwan (Taipei)	501.0	Norway	503.0	Australia
502.6	Prince Edward Island	500.0	**Germany G7**	502.4	**United States G7**
501.1	Denmark	499.6	Ireland	501.5	Prince Edward Island
499.5	Norway	499.5	Czech Republic	500.8	Saskatchewan
499.3	Saskatchewan	498.9	Austria	499.4	Sweden
498.3	**Germany G7**	496.1	Latvia	498.8	Belgium
495.3	Slovenia	495.4	**France G7**	496.8	Czech Republic
494.4	Manitoba	495.2	Iceland	496.1	Ireland
492.9	Belgium	494.5	New Zealand	495.3	Switzerland
492.6	**France G7**	494.3	Nova Scotia	493.0	**France G7**
491.8	Portugal	492.5	Portugal	492.6	Denmark

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Reading		Math		Science	
Score	*Country*	*Score*	*Country*	*Score*	*Country*
490.2	Czech Republic	491.4	Australia	492.4	New Brunswick
489.1	New Brunswick	490.7	New Brunswick	491.7	Portugal
484.8	Netherlands	488.5	Newf'd & Labrador	490.4	Norway
		487.8	Russia	489.8	Austria
		486.6	**Italy G7**	489.4	Manitoba
		486.5	Prince Edward Island	487.3	Latvia
		485.2	Saskatchewan		
		481.5	Manitoba		
		481.4	Spain		

Notes: Shaded cells mean scores not significantly different from Canada at the 95% confidence level.
Percentile Formula: Ave X(p[n+1]).

Source: OECD (2019a): Tables I.B1.4, I.B1.5, I.B1.6, I.B2.9, I.B2.10, and I.B2.11; author's calculations.

Statistically Significant Score Differences

Table 2 is an expanded version of the ranked subject means shown in table 1, with the ten provinces inserted according to their estimated average scores, and with the percentile markers adjusted for the extended distributions. Alberta's third place position in reading and fourth place in science is immediately notable, as is Quebec's fifth place in math. In each case these scores are significantly higher than the Canadian national scores at the 95 percent level of statistical confidence. The relative margins of error make the reading scores for Alberta and Ontario statistically similar, effectively awarding both provinces pride of place among provincial scores in reading. While Quebec's math score is not statistically different from those of Taiwan, Japan, and Korea, it stands head and shoulders above all other provincial math scores. So, too, with Alberta's science score which, while statistically similar to Estonia and Japan, is statistically higher at the 95 percent confidence level from Quebec's next closest score, and hence all other provinces.

In each subject there is a cluster of provinces with similar scores not significantly different from the Canadian estimated average score, as highlighted in the table by the shaded cells. The most compact grouping is in reading, where Nova Scotia and Newfoundland and Labrador join Ontario, Quebec, and British Columbia as well as five countries with scores not significantly different from Canada, all clustered around the 90th percentile. Math scores for Alberta, Ontario, and British Columbia, together with those of six other countries, are all statistically similar to the Canadian national score, and fall below the 90th percentile. In science, scores for Quebec, Ontario, and British Columbia as well as those of four countries form a group not significantly different from Canada around the 90th percentile of the distribution. Nova Scotia, Newfoundland and Labrador, and Prince Edward Island are also shown as having science scores not

statistically different from Canada, but in isolated positions lower in the distribution. This is because of the larger measurement errors associated with the small sample sizes in those provinces producing expanded confidence intervals. This effect makes it impossible to make statistically precise distinctions between many of the Smaller Six provinces. As such, there are no statistically significant differences between the scores of the four lowest ranked provinces in the reading distribution, or for all members of the Smaller Six provinces clustered at the low end of the math distribution. In each case these lower scoring provinces fall below the 75th percentile of the overall score distributions. So, too, with the four lowest scoring provinces in science, but in this case Saskatchewan's score is significantly higher than those for New Brunswick or Manitoba, even though the differences between their scores and that for Prince Edward Island are not statistically significant due to the unusually large confidence interval for PEI.

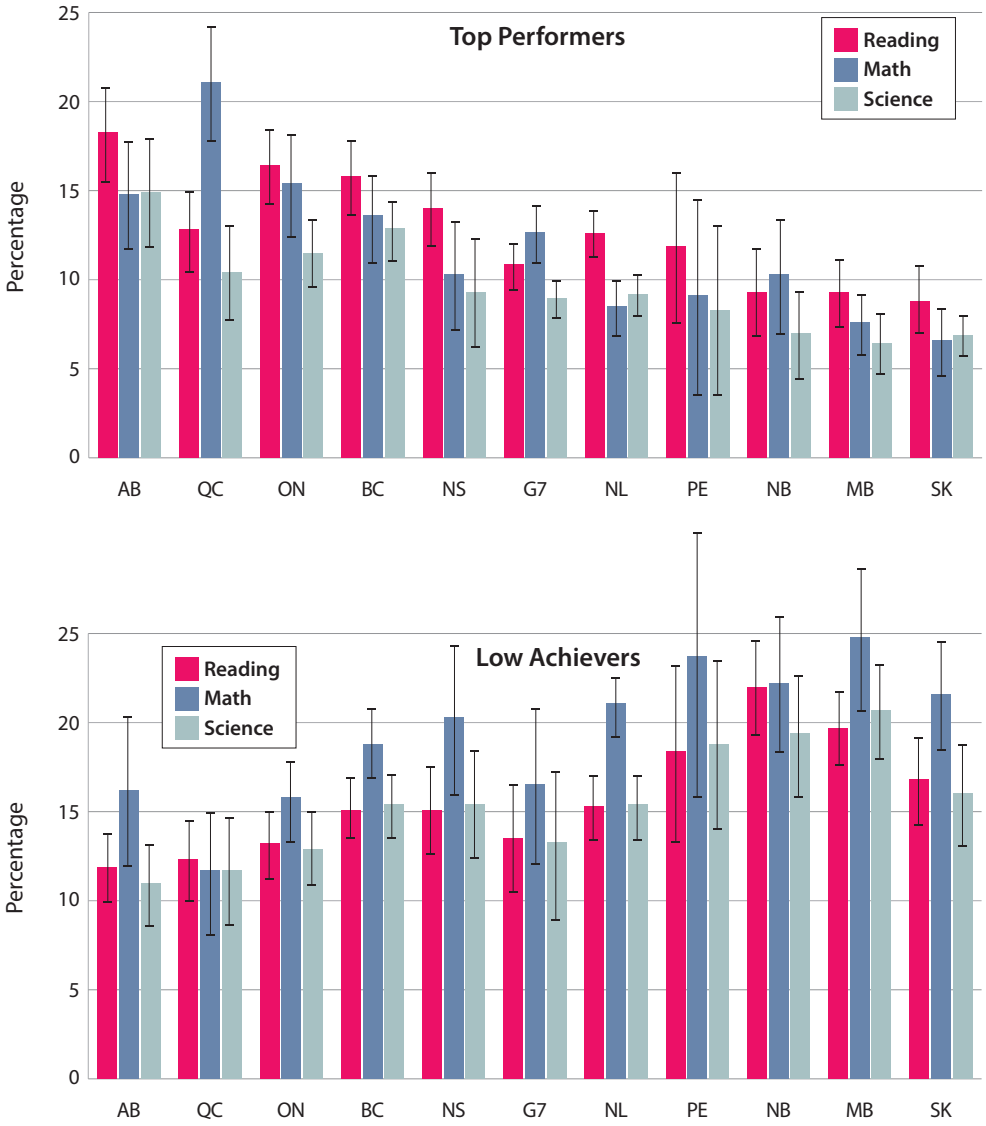
In review, the provincial distributions in table 2 are headlined by the outlying high scores of Alberta and Quebec, augmented by the statistical tie between Alberta and Ontario in reading, while the lower reaches of the distribution are populated exclusively with Smaller Six provinces. In reading, two of these smaller provinces (Nova Scotia and Newfoundland and Labrador) are included in the group of larger provinces falling within the zone of non-significant statistical difference around the national score. The same two provinces as well as Prince Edward Island were also included in the zone of non-significant difference around the national score in the science distribution. All six smaller provinces are clustered in the lower range of scores in the math distribution, which also has the largest range of provincial scores. The competitive performance of the Big Four provinces among the higher scoring national education systems—especially Alberta, Ontario, and Quebec—is impressive. But this should not overshadow the relative competitiveness of the smaller, lower-scoring provinces internationally. While New Brunswick was the lowest scoring province in reading, its performance was a statistically significant 13 score points higher than G7 Italy. In math, Manitoba outscored G7 USA, albeit marginally and non-significantly, but in science Manitoba recorded a significant 21-point higher score than did Italy.

Provincial High Performers and Low Achievers in PISA 2018.

Figure 6 shows the percentages of top performers and low achievers in each subject for each province, together with the averages for the G7 national systems for reference. As in figure 2, the horizontal axes are ranked in descending order of the average percentages of top performers in the three subjects.

The upper panel of figure 6 shows a shallow left-to-right decline in the provincial proportions of top performers, with relatively small differences and long, overlapping error bars presenting a confused impression, especially for the smaller provinces. The average percentage of top performers in all three subjects falls from 16 percent in Alberta to 7.4 percent in Saskatchewan, with PEI, New Brunswick, and Manitoba all having less than ten percent of top performers in the three subject average. Nova Scotia, Newfoundland and Labrador, and PEI had the highest proportions of top performers among the six smaller provinces. As could be expected from Quebec's dominance in

Figure 6: Percentages of Top Performers and Low Achievers by Subject, Canadian Provinces and G7 Average



Note: Jurisdictions ranked by decreasing values for the average percentages of top performers in all three subjects.

Source: CMEC (2019); OECD (2019a): Tables I.B1.1, I.B1.2, and I.B1.3; author's calculations.

math noted earlier, Quebec's 21 percent of top performers in math stands significantly higher than all other provinces and the average for the G7 countries. Ontario (15.4%), Alberta (14.8%), Nova Scotia (10.3%), and New Brunswick (10.3%) form a second rank group in math, each with statistically similar shares of top performers. Alberta had the highest proportion of top performers in reading (18.3%), but was statistically tied with Ontario (16.4%), British Columbia (14.9%) Nova Scotia (14.0%), and PEI (11.5%). In science, Alberta's 15 percent share of top performers is statistically indistinguishable from

the other Big Four provinces. In eight provinces, the relative subject pattern of top performers is reading > math > science. In all cases except Newfoundland and Labrador, differences in the relative in-province subject shares of top performers are not statistically significant. In Newfoundland and Labrador, the 12.6 percent share of top performers in reading was significantly larger than the 9.2 and 8.5 percent shares in science and math respectively. In Quebec and Manitoba, the relative subject pattern is math > reading > science, as is the case with the G7 subject averages. In Quebec, the 21 percent of top performers in math is significantly larger than the 12.8 and 10.4 percentages in reading and science respectively.

The lower panel of figure 6 shows low achievers. There is relatively little between-province variation, the subject averages ranging from a low of 11.9 percent in Quebec to a high of 21.7 percent in Manitoba. The greatest range is in math, from a minimum of 11.7 percent of low achievers in Quebec, to a maximum of 24.8 percent in Manitoba. Quebec's share of low achievers in math is significantly smaller than all provinces except Alberta (16.2%) and Ontario (15.4%), and the G7 average (16.5%). There are proportionally more low achievers in math in all provinces except Quebec and New Brunswick, but the only statistically significant difference is in Newfoundland and Labrador, where the 21.1 percent of low achievers in math overshadows the 15.4 and 15.3 percentage shares in science and reading respectively.

Only the Big Four provinces had positive differences between their shares of top performers and low achievers. In reading, Alberta and Ontario's top performers exceeded their low achievers by 6.4 and 3.2 percentage points respectively, the differences for British Columbia (0.7) and Quebec (0.5) verging on parity. Quebec was the only province with a positive difference (9.4) in math, and Alberta the only province with a positive difference (3.9) in science. In all other instances, there are negative differences between the proportions of high and low achievers. Manitoba (-10.4) and New Brunswick (-12.7) recorded the greatest performance disparities in reading, Saskatchewan (-15) and Manitoba (-17.2) in math, and New Brunswick (-12.4) and Manitoba (-14.3) in science. The achievement differences for all subjects in the G7 averages are also uniformly negative, but are of a much smaller magnitude, the greatest gap being the -4.4 percentage point difference between the proportions of top performers and low achievers in the G7 science average.

In sum, an average of 15 percent of Grade 10 students in Canada's four largest provinces did sufficiently well in the PISA 2018 assessment to be classified as top performers, with 21 percent of Quebec students performing at this level in math, as well as 18 percent and 15 percent of Alberta students in reading and science. At the other end of the achievement scale, one-fifth or more of Canada's 15 year-olds failed to exceed low levels of performance in at least one of the three subjects. Prince Edward Island has more than twice as many low achievers as high performers in math and science, and New Brunswick has similar negative ratios in all three subjects. Saskatchewan also has twice as many low achievers as top performers in science, and more than three times as many in math. Manitoba has twice as many low than high achievers in reading, and more than three times as many in math and science. These are serious imbalances.

Performance Trends Across the Provinces

As shown earlier in figure 3, Canada's average subject scores have declined significantly since the initial baseline measurements. As also discussed earlier, so have Canada's relative shares of high and low performing students, with significant increases in low achievers and significant decreases in top performers. These declines were not shared evenly across the provinces.

Shifts in Proficiency Shares

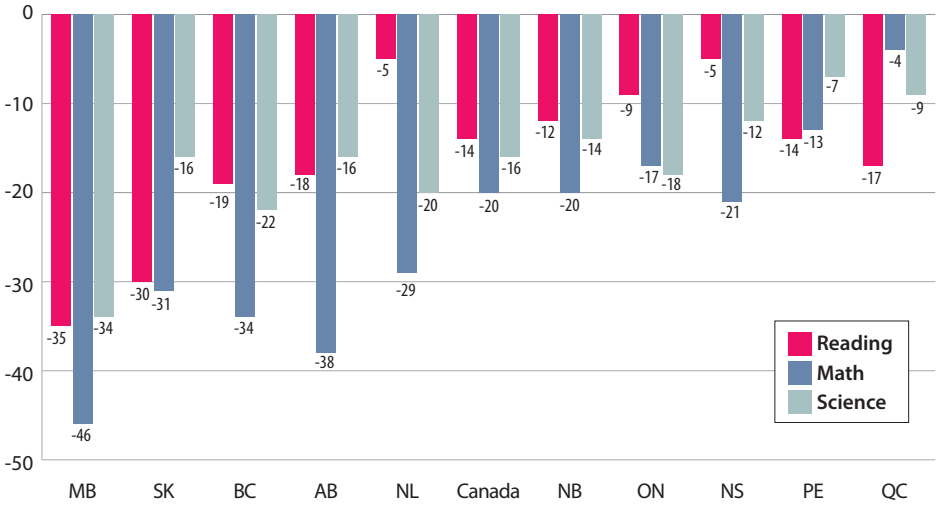
Drawing on the limited cycle-to-cycle comparisons in the CMEC (2019) report, over the 2009–2018 period Newfoundland and Labrador and Prince Edward Island significantly increased their top performers in reading by 4.1 and 5.0 percent respectively (p. 104). These were the only statistically significant gains reported in any subject over the comparison periods considered. Over the same 2009–2018 period, four provinces, including two of the Big Four, had significant increases in their low achievers in reading: Nova Scotia by 4 percent, British Columbia by 4.4 percent, Ontario by 4.8 percent, and New Brunswick by 5.8 percent (CMEC, 2018: 104). Over a shorter 2012–2018 comparison period, both New Brunswick (6 percent) and British Columbia (6.5 percent) also gained significantly more low achievers in math (CMEC, 2018: 164). Over this same period, Saskatchewan experienced a substantial net proficiency erosion of 11.9 percent in math, as a result of a significant 5.6 percent decrease in top performers and a significant 6.3 increase in low achievers (CMEC, 2018: 164). Over the most recent comparison period reported, from 2015 to 2018, British Columbia gained a significant 6.5 percent of low achievers in science: Quebec and PEI also had significant 3.3 percent and 7.5 percent increases in science low achievers respectively over this period (CMEC, 2018: 164).

In review, the increasing proficiency gaps observed on the national level as discussed earlier and summarized in figure 6, were—over the limited comparison periods for which data are available—primarily concentrated in British Columbia, New Brunswick, and Saskatchewan, with smaller, yet statistically significant, increases in the proportions of low achievers in PEI, Nova Scotia, Quebec, and Ontario. In contrast, Alberta and Manitoba had no statistically significant gains or losses in low or high achievers over the periods considered. Prince Edward Island and Newfoundland and Labrador gained significantly more top performers in reading without any significant increase in low achievers, the only provinces with such a record for the periods considered.

Declines in Subject Scores

Canada's declines in estimated average subject scores were also disproportionally distributed across the provinces, as shown by the inverted bar chart in **figure 7**. This data display focuses on the magnitude of declines in estimated average scores by charting the differences between 2018 subject scores and the initial baseline years, 2000 for reading, 2003 for math and 2006 for science, By considering only baseline-to-2018 changes, the display ignores any intervening fluctuations.

Figure 7: Score Point Changes, Baseline to 2018, by Subject for Provinces and Canada



Note: Baseline years are 2000 for reading, 2003 for math, and 2006 for science.

Source: Statistics Canada (2020).

The companion displays in **figure 8** and **Appendix B** show fluctuations in subject scores between the end points charted in figure 7 by plotting estimated mean scores for each PISA cycle. Subject scores are plotted against a common scale on the vertical axes, with a linear regression trend line added to facilitate comparisons. Figure 8 shows score trajectories for the Big Four provinces; Appendix B for the Smaller Six provinces.

All three data displays show declines for each subject in all provinces. The graphs in figure 8 and Appendix B show occasional intermediary increases eventually being cancelled out with greater declines, some resulting in overall decline and some producing flatter score trajectories. At any rate, the graph traces for all ten provinces and each subject always culminate in lower 2018 scores. All but four of these declines are statistically significant over at least one of the assessment cycles. More specifically, the cycle-to-cycle score changes in Ontario reading, Quebec math, and in Nova Scotia and New Brunswick science were not statistically significant (Statistics Canada, 2020). The relevant plots in figure 8 and Appendix B show the score trajectories in these cases were either flat, as in Ontario reading and Quebec math, or fluctuated around a shallow, negatively sloped trend line, as in the two maritime provinces.

Figure 7 shows the greatest overall score declines were in Manitoba, Saskatchewan, British Columbia, Alberta, and Newfoundland and Labrador. Manitoba stands out as experiencing the most substantial declines, amounting to an average decline of -38 score points across all three subjects totaling -115 score points for the sum of all three subjects. Taken together, the other four provinces in this greatest decline list had an average all-subject total score decline of -70 points. The remaining five provinces with less substantial score declines lost an average sum of -38 points overall.

Figure 8: Subject Score Trajectories for Big Four Provinces

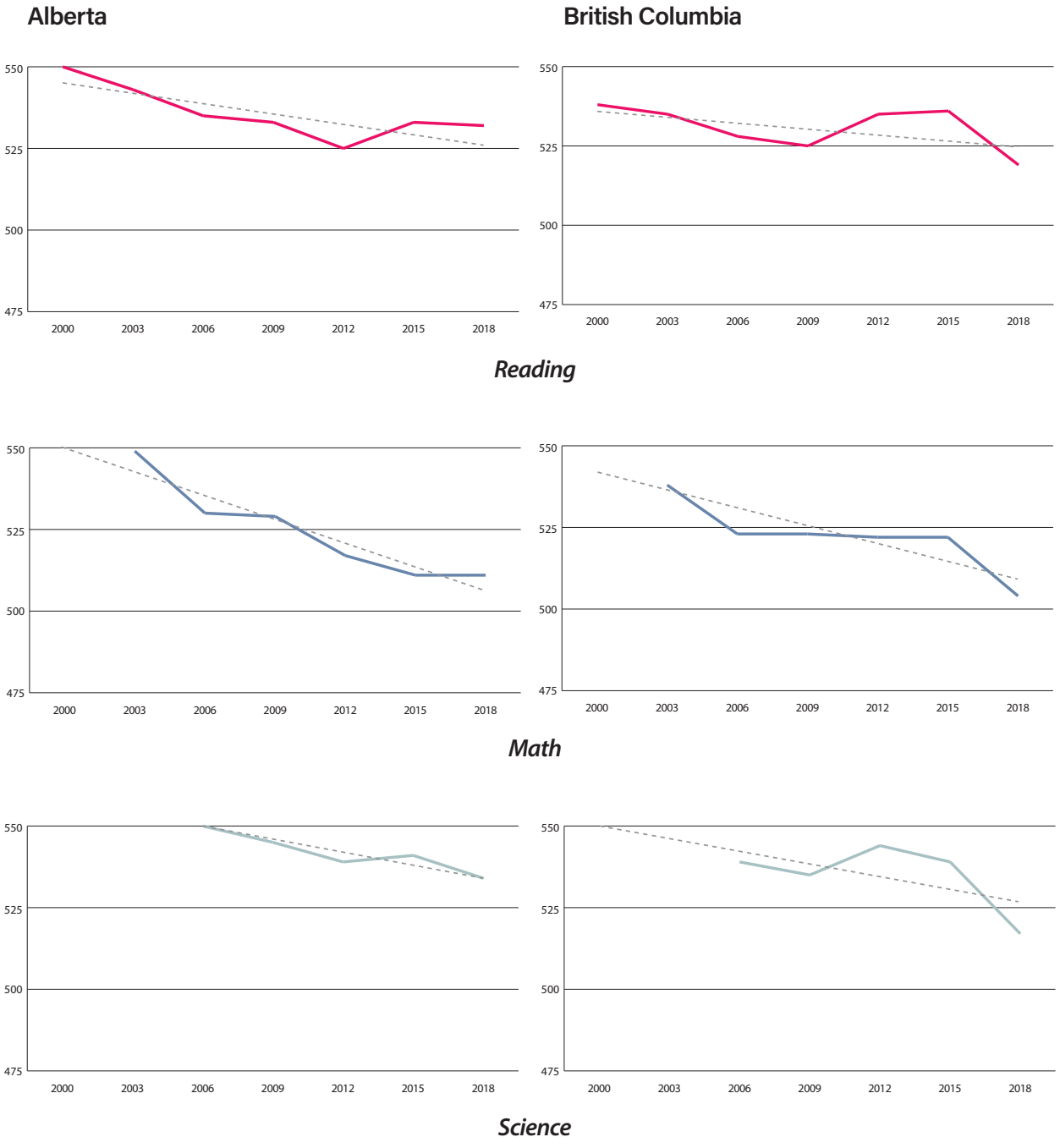
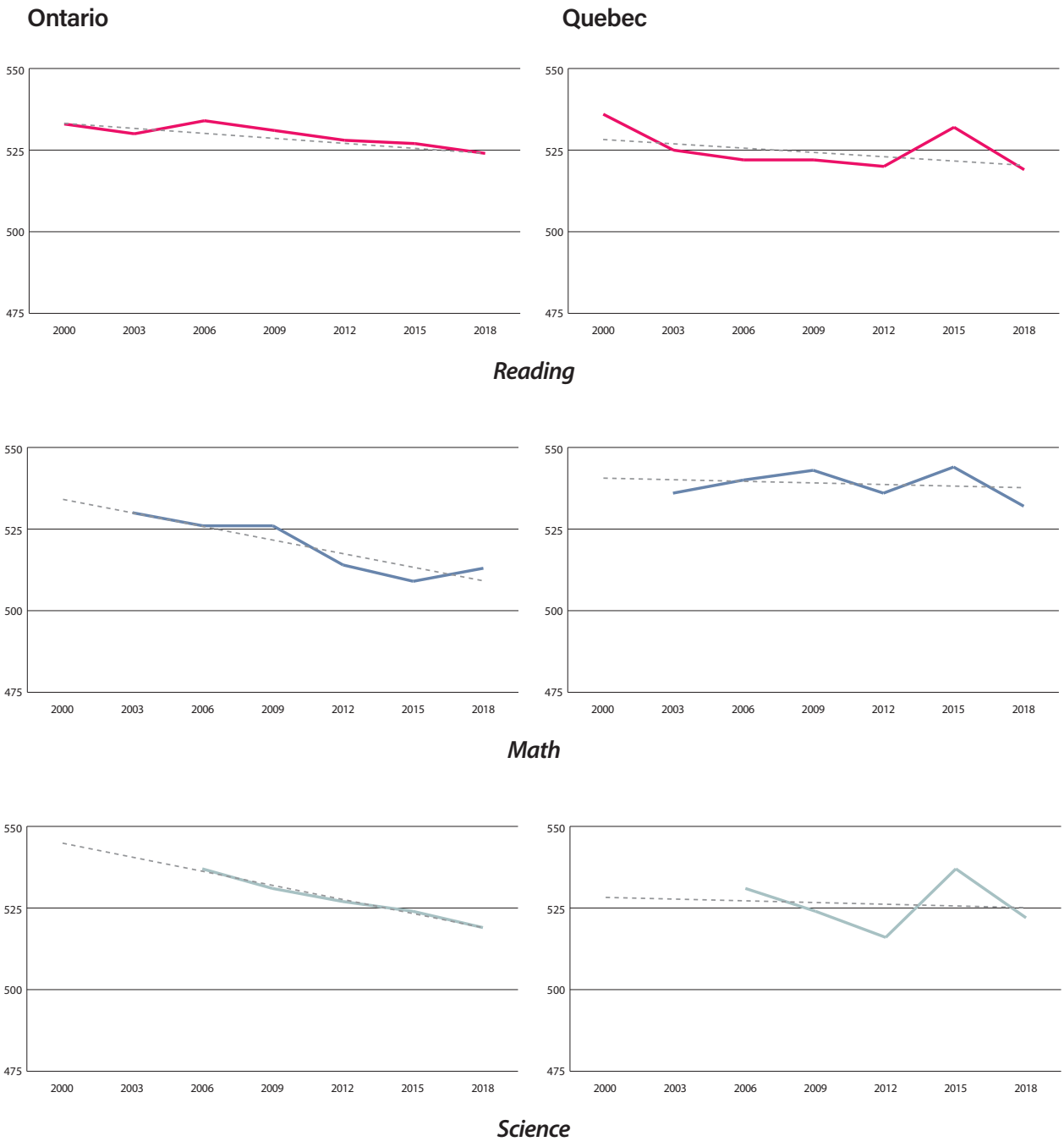


Figure 8, continued: Subject Score Trajectories for Big Four Provinces



Source: Statistics Canada (2020): Table 37-10-0149-01.

In all but Saskatchewan, Ontario, PEI, and Quebec, the subject with the largest score declines is math, starkly so in many cases. In Saskatchewan and PEI the overall decline in math scores is effectively tied with the point losses in reading; in Ontario math and science declines are tied; in Quebec, and only in Quebec, math was the subject with the smallest decline, just -4 score points, which is also the smallest decline in all provinces for any subject. The largest declines in math are in Manitoba (-46), Alberta (-38) and British Columbia (-34).

The math plot for Manitoba in Appendix B shows a steadily negative trajectory. Those for Alberta and British Columbia in figure 8 show steep negative gradients with short plateaus between 2005 and 2009 for Alberta and over a four cycle mid-span period in British Columbia. All other provinces except Quebec have similar, not always as steep, negative patterns in math. Saskatchewan has a stepped decline with a levelling between 2015 and 2018, and PEI a steep drop after an initial plateau, followed by a recovery, then another steep drop, the recovery reducing the total overall baseline-to-2018 decrease to just -13 points. The math trajectories for the two remaining Big Four provinces shown in figure 8 are less severe. Ontario experienced its largest score decline in math between 2009 and 2015, with a small uptick between 2015 and 2018. Quebec, as noted earlier, had its smallest decline in math, scores following a generally flat trajectory containing two shallow increases and a sharper drop over the latest 2015–2018 period.

Quebec's score declines in reading and science embody similar trend aspects. In reading, Quebec's score plateaued after a small decline, then described a shallow hump shape, tending downward over the last two cycles. A similar but more pronounced pattern is evident in the trajectory of Quebec science scores, with the 2018 score being only 7 points below the 2006 benchmark. Ontario also has relatively mild declines overall. The province's greatest decline was a slightly below average 18 score point drop in science, along a steadily negative, but shallow, trajectory. As described earlier, the decline in Ontario's math scores was also relatively small along a more varied yet still modestly negative trajectory. Ontario's small, non-significant decline of -9 score points in reading since 2000 along an essentially flat trajectory ranks alongside Quebec's almost neutral performance in math.

Two other patterns of interest are the relatively strong (less negative) reading performances by Nova Scotia and Newfoundland and Labrador. Following a statistically significant drop between 2003 and 2006, Nova Scotia's reading scores oscillate above and below a flat trend line, twice dipping below the terminal 2018 score. Given this, the overall decline of -5 score points shown in figure 7 hides a more complex, but nonetheless relatively respectable, performance. As shown by the graph in Appendix B, Newfoundland and Labrador's matching overall drop of -5 score points in reading was arrived at by a different, and seemingly more promising, route, with a small, steady, but nonetheless not statistically significant increase over the last three cycles. This minor rise in reading scores is accompanied by a flattening of Newfoundland and Labrador's math and science scores in 2018, which may auger well for the future.

In sum, the all-subject decline in Canada's national-level scores was mirrored across the provinces, but was less severe in some, most importantly the two largest. Quebec's consistently outstanding performance in math produced a small, non-significant decline in that subject, while Ontario's steady performance in reading also produced only a small, non-significant, score decline. These small, non-significant score declines in the largest provinces served to prevent steeper declines at the national level. While experiencing the third largest score drop in math, Newfoundland and Labrador had the smallest decline in reading with a small increase over the last two assessments which, together with flattening score trajectories in science and math, shows future promise. The patterns elsewhere were less promising. The steepest and largest overall score declines were in Manitoba, but British Columbia's sharp and steep declines in all subject scores, but particularly math, over the 2015–18 period is worrisome.

Contextual Data

In addition to the performance measures considered above, each PISA cycle collects supplementary data through questionnaires completed by students and school staff. This final section reviews relationships in the 2018 data between the academic performance of Canadian and other students, and two contextual measures, the PISA index of economic, social, and cultural status, and a related estimate of individual academic success.

Socio-economic Status and School Success

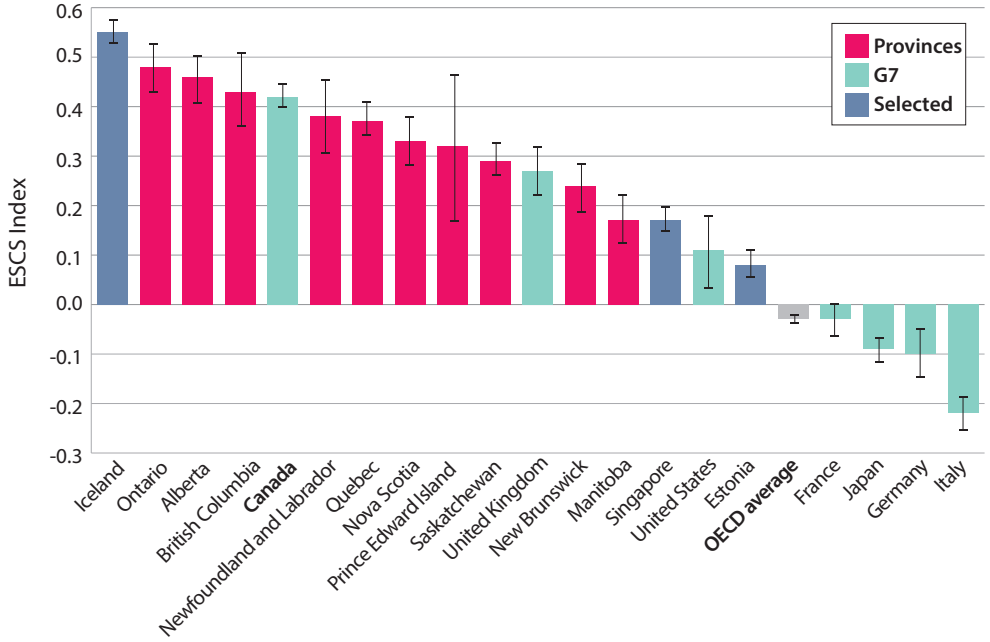
Children living in well-provided, financially secure homes with highly educated parents typically do well in school. The pervasiveness and power of what is, at least in part, an intergenerational return on prior investments in education was extensively demonstrated in the landmark *Equality of Education* survey of schools and schooling in sixties USA (Coleman et al., 1966). [15] This, and many subsequent studies, show that students' socio-economic circumstances can be strong—but not determinative—predictors of school success. Exploring the strength of this relationship in different school systems and considering how policies and operational practices can assist students to realize their academic potential despite disadvantages associated with their socio-economic circumstances is a major focus of the PISA project.

PISA measures socio-economic status with the index of economic, social, and cultural status (ESCS). This is constructed from student responses to questionnaire items about their parents' education and employment, and household possessions and circumstances, including the availability of a quiet study space, internet access, and the number of books in the home (OECD, 2019b: 52). The index is standardized to a mean of 0 with a standard deviation of 1. The two highest scoring countries in the 2018 cycle were Iceland (0.547, *SD* = 0.81) and Norway (0.542, *SD* = 0.82); the two lowest Viet Nam (-1.62, *SD* = 1.08) and Morocco (-1.89, *SD* = 1.42). Canada placed 4th with an ESCS index score of 0.42 (*SD* = 0.02).

Figure 9 is a bar chart of ESCS scores for the Canadian provinces, together with G7 members and several additional countries for comparison. The error bars map 95 percent confidence intervals above and below the estimated values. The relatively small sample sizes for the smaller provinces expand the confidence intervals, limiting statistically meaningful comparisons, as illustrated by Prince Edward Island in particular. Even so, all the provinces have significantly higher ESCS scores than the OECD average and

[15] This famous study was initiated by the Civil Rights Act of 1964 which mandated a "survey ... concerning the lack of availability of equal educational opportunities for individuals by reason of race, color, religion, or national origin in public educational institutions at all levels in the United States ..." (Coleman et al., 1966: iii). A subsequent, more evocatively entitled but now largely forgotten study, *Stations and Callings: Making it Through the School System*, documented parallel associations between socio-economic status and school access and success in Ontario (Porter, Porter, and Blishen, 1982).

Figure 9: PISA18 participants by decreasing ESCS Index Score (SES) for Provinces, G7 members, and Selected Comparison Systems

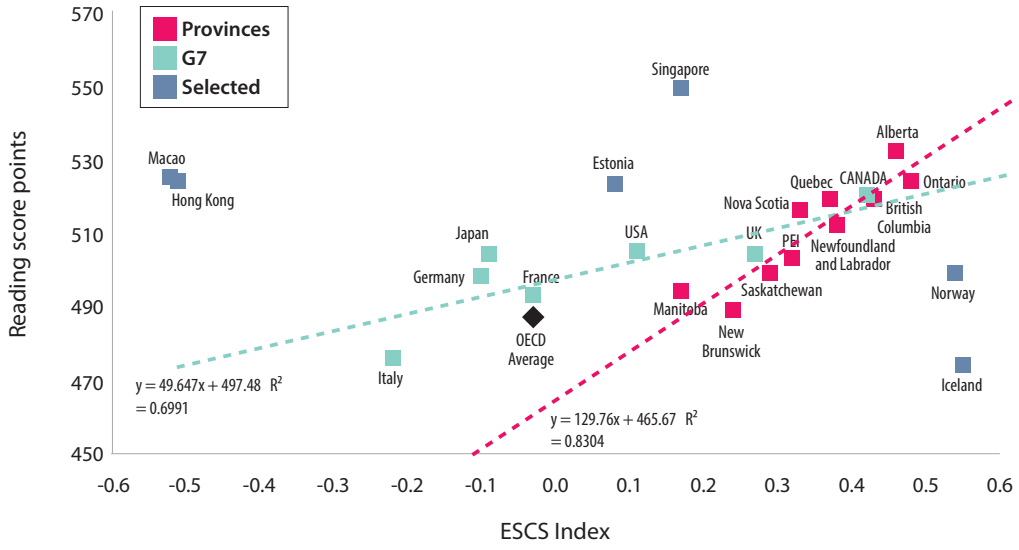


Source: OECD (2019b): Tables II.B1.2.1, and II.B2.1; author's calculations.

four G7 countries. The Big Four provinces have significantly higher scores than the United Kingdom, the second ranked G7 member after Canada. Canada's ESCS score is nonetheless significantly lower than top-scoring Iceland, as well as second and third ranked Norway and Denmark (not shown), but significantly higher than Sweden (not shown), the next highest ranked country, and thus all other OECD members. Within Canada, Ontario has the highest ESCS score, which is statistically indistinguishable from Alberta, British Columbia, and Newfoundland and Labrador at the 95% confidence level, but significantly higher than Quebec and all other provinces. New Brunswick and Manitoba have the lowest scores among the provinces, scores which are nonetheless comparable with the USA and Singapore.

Figure 10 plots average ESCS index scores against estimated average reading scores for the provinces, G7 members, and selected comparison countries. Linear regression lines for the provinces ($R^2 = 0.831$, $p < .000$) and G7 countries ($R^2 = 0.699$, $p = .019$) show strong positive correlations between academic performance and socio-economic status for these sets of systems. Even so, Iceland and Norway, the countries with the highest ESCS scores shown in the display, both have relatively low reading scores. Norway, with the highest reading score of these two countries, falls significantly below the Canadian national score as was shown earlier in table 1, and significantly below the five top scoring provinces, as summarized in table 2. Moreover, Singapore, with the highest reading score shown on the plot (second only to China (BSJZ), not shown), has a significantly lower ESCS score than Canada and seven provinces. Estonia, the highest scoring OECD

Figure 10: ESCS Index and Reading Scores for Provinces, G7, and Selected Systems



Source: OECD (2019a): Tables I.B1.4, I.B2.9; OECD (2019b): Tables II.B1.2.1, II.B2.1; author's calculations.

country in PISA 2018 with a statistically similar reading score to Canada, also has a significantly lower ESCS score than Canada and all provinces except Manitoba. The weaker relationships for high-scoring Macao and Hong Kong are even more marked, both systems having ESCS scores below -.04. These relationships are not exceptions to the pervasive positive correlation between academic performance and SES, but rather instances where the relationship between SES and achievement are weaker than the strong correlations evident for the G7 countries and Canadian provinces.

Relative Influence of SES

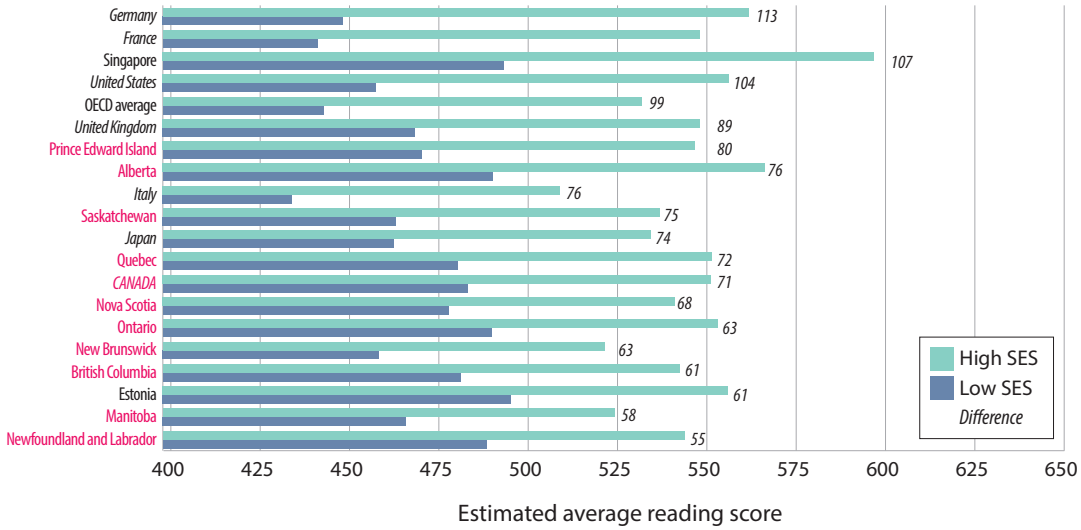
Throughout the PISA results, SES and academic performance are positively related, but the relationship is not determinative, leaving scope for other factors to influence academic outcomes, especially the abilities, talents, motivation, and industry of individual students. Furthermore, system policies, the cultures of individual schools, teacher professionalism, and the quality of instruction will help or hinder student progress and, in doing so, ameliorate—or reinforce—disadvantages associated with students' socioeconomic circumstances.

This is demonstrated by the everyday reality of students from disadvantaged circumstances who perform well in school, as it is by students from the better side of town who do not do so well. PISA operationalizes this variability by comparing the average reading scores of students in the lower quartile of national or sub-national ESCS distributions—designated disadvantaged—with those in the highest—termed advantaged—quartile. This provides a comparable estimate of the overall influence of national or sub-national SES on academic performance.

In PISA 2018, advantaged students in OECD systems outperformed their disadvantaged counterparts by an average 89 score points in reading (OECD, 2018b: 56). Even so, this performance gap was notably greater in some systems than others, exceeding 100 in nine OECD nations, including France (107) and Germany (113), with Luxembourg's performance gap of 122 score points being the largest. Other countries had much smaller differences between the average scores of SES disadvantaged and advantaged students. The performance gaps in three OECD members were less than 70 score points in reading: Estonia (61), Latvia (65) and Canada (68). The smallest performance gap in PISA 2018 was in Macao, where the difference between the average reading score in the lower and upper quartiles of the ESCS scale was just 32 points.

Figure 11 charts and compares performance gaps for the provinces, G7 countries, and selected comparison systems. The green bars show estimated average reading scores for advantaged students; the blue bars, estimated average reading scores for disadvantaged students. Systems are ranked by decreasing performance gaps, from a high of 113 for Germany to a low of 55 for Newfoundland and Labrador. At the national level, Canada has a significantly smaller performance gap than all G7 members except Italy and Japan. All the provinces have significantly smaller performance gaps than the OECD average, as well as significantly smaller performance gaps than Singapore, France, and Germany. Manitoba (58) and Newfoundland and Labrador (55) have the smallest performance gaps among the provinces; PEI (76) and Alberta (76) the largest, but none of the differences between provinces are statistically significant at either the 95 or 90 percent confidence levels (OECD, 2019b: Tables II.B1.3.1 and II.B2.5). This can be interpreted as showing that while there is a decrease in the estimated performance gaps across the provinces, students in all provinces face average levels of socio-economic disadvantage which are significantly low by international standards.

Figure 11: Performance Gap in Reading Between Low and High SES Students for Provinces, G7, and Comparision Systems



Source: OECD (2019b): Tables II.B1.3.1, II.B2.5; author's calculations.

In sum, school children from socially, culturally, and financially disadvantaged homes around the world face real difficulties in school. The hill they must climb to achieve academic success is nevertheless steeper in some jurisdictions than others. Relatively low performance gaps in Canada and all the provinces show that disadvantaged students across the country have relatively good opportunities to benefit from the high performance levels of Canada's education systems than do young people in comparable countries, conferring relatively greater opportunities for social mobility on Canadian students.

Academic Resilience

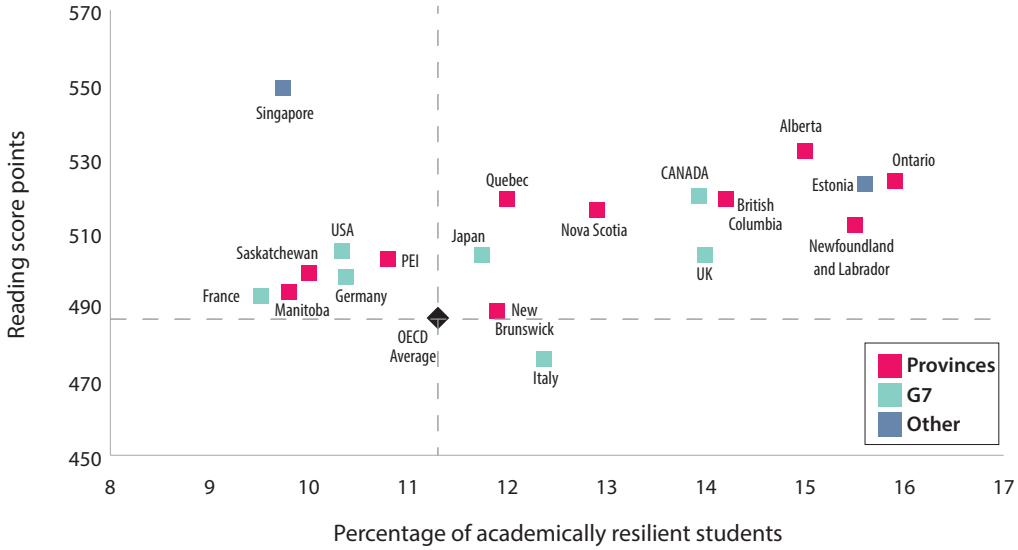
Students from the lower quartile of their national or sub-national ESCS index distribution who also place in the upper quartile of the reading score distribution are termed academically resilient (OECD, 2018b: 66). Despite the challenges of their birth and household circumstances, they attain a relatively high level of educational attainment through ability, motivation, effort, encouragement, support, assistance and some luck. Education policies—which are predominantly provincial policies in Canada—will also influence observed levels of academic resilience by enhancing or restricting education opportunities and progress. Whatever specific production functions are involved, education systems with proportionally more higher achieving students from low SES circumstances are enabling more young people to overcome initial disadvantages. In doing so they are expanding education opportunities and promoting greater equity (OECD, 2018b: 42–46).

In PISA 2018, an average of 11.3 percent of disadvantaged students in OECD systems were academically resilient. Macao (19.8 percent) had the largest proportion of academically resilient students among all participating countries; Peru (6.2 percent) the lowest. Canada (13.9 percent) was the fourth ranked OECD member, after Estonia (15.6 percent), Turkey (14.5 percent), and the UK (14 percent).

Figure 12 plots the percentage of academically resilient students against estimated average reading scores for the provinces, G7 members, and selected comparison systems. Canada (13.9 percent) has a significantly larger share of academically resilient students than all other G7 members except the UK (14 percent). With an average of 15.9 percent, Ontario has the highest proportion of academically resilient students of the jurisdictions shown, significantly more than France (9.5 percent), Singapore (9.7 percent), Saskatchewan (10 percent) the US (10.3 percent), Germany (10.4 percent) and the OECD average (11.3 percent), but not significantly different from Estonia (15.6 percent) or the UK (14 percent). Macao (19.8 percent) and Hong Kong (16.5 percent) (neither shown), were the only two national school systems in PISA 2018 with higher proportions of academically resilient students, but neither score was significantly higher than Ontario.

The more powerful messages in figure 12 are in the upper right quadrant of the chart which contains systems with higher proportions of resilient students than the OECD average *and* those with higher estimated average reading scores than the OECD average. Education systems in this quadrant are both high performing and highly equitable. Four national level systems with these scores are not shown in the figure. China (BSJZ) and Macao are omitted because, as discussed earlier, the reading score of the

Figure 12: Reading Performance and Academic Resilience for Provinces, G7, and Selected Comparison Systems



Source: OECD (2019a): Table I.B1.4; OECD (2019b): Tables II.B1.3.1, II.B2.5; author's calculations.

first appears suspect, and the resilience score of the second would expand the horizontal axis by three full percentage points, overly compressing the display. The other two excluded systems are Denmark and Norway, which are omitted for clarity. Both systems are located close to Japan and above New Brunswick on the plot. Taking the omitted systems into account, the high performance and equity score quadrant contains eight national systems, including three G7 members (Canada, United Kingdom, Japan) and Estonia, the highest scoring OECD country. Seven provincial education systems also fall within this quadrant, the Big Four and Newfoundland and Labrador, Nova Scotia, and New Brunswick. Viewed alongside table 2, the combined performance of Alberta and Ontario is particularly notable: Alberta with a reading score above the 95 percentile in the combined international and provincial score distribution and with the 5th largest proportion of academically resilient students; Ontario with the second highest share of academically resilient students after Macao and a reading score above the 90th percentile, which is statistically tied with Alberta and Estonia. The presence of three Atlantic provinces in the High Performance—High Equity quadrant is also notable, especially Newfoundland and Labrador's high proportion of academically resilient students.

In review, as illustrated in figure 10 the socio-economic circumstances of Canadian children are positively associated with school performance, as in all other jurisdictions. The relatively high ESCS scores enjoyed by Canada and in all provinces, as shown in figure 9, places Canadian children in generally less-disadvantaged conditions than those in most other countries, presenting, on average, provincial school systems and at least some schools with less demanding SES-rooted challenges than those faced in many other systems. This is reflected in the smaller performance gaps in the academic achievement

of higher and lower SES students summarized in figure 11. Yet while some SES disadvantaged children in Canada may have something of a shallower hill to climb in school than those elsewhere, the high proportions of academically resilient students in Canadian provinces highlighted in figure 12 shows relatively high numbers of disadvantaged young Canadians have successfully climbed the hill to school success, more on average than their counterparts in most of the other economically advanced and prosperous G7 countries have done. In short, Canadian schools appear to be doing a comparatively good job of helping disadvantaged children succeed. This is commendable in itself, but taken together with the high levels of academic performance achieved by Canadian schools, as also illustrated in figure 12 and summarized in table 2, Canada and its provincial school systems exhibit commendably high levels of both excellence and equity.

Conclusion

The most recent iteration of the OECD's Programme for International Student Assessment of 15-year-olds highlights ways in which Canada continues to benefit from its investments in education. In addition to maintaining its position in the top echelon of subject scores among the 78 participating countries, Canada enjoyed a notable edge among G7 members.

Overall, Canada performed least well in math and slightly better in science, scoring a little below the 90th percentile in both mark distributions, significantly below Japan but above the United Kingdom and other G7 nations. Canada excelled in reading, placing slightly below the 95th percentile and significantly below only three other countries—China (BSJZ), Singapore, and Macao (China). Canada also had superior proportions of higher and lower achieving students, especially in reading. This was most evident at the lower end of the performance scale where Canada had fewer poor achievers in all three subjects than all other G7 countries except for Japan in science.

The lack of a federal education authority and a national education policy framework makes the performance of Canada's schools more dependent on sub-national policies and priorities than is generally the case in other countries. Canada's four largest provinces dominated the 2018 (and earlier) results, Quebec excelling in math and Alberta in science and reading, with Ontario statistically tied with Alberta in reading. Strikingly, Alberta claimed third place internationally in reading, behind only China (BSJZ) and Singapore, while Quebec occupied fifth place in math internationally. British Columbia scored below the three larger provinces in all subjects.

Manitoba, Saskatchewan, and New Brunswick had the lowest provincial scores in reading and science. The two prairie provinces also had the lowest scores in math, together with PEI. The middle range of the score distribution was consistently occupied by Nova Scotia and Newfoundland and Labrador. This pattern was reflected in the proportions of higher and lower performing students, with the Big Four provinces recording more top performing students in all subjects except reading, where Nova Scotia supplanted Quebec. One fifth or more of students in Prince Edward Island, Manitoba, and New Brunswick attained only the minimal level of achievement in one or more subjects.

While the Big Four provinces dominated performance results overall, Alberta, with only 14 percent of national enrolment, stood head-and-shoulders above all provinces in reading and science, while Quebec, with 20 percent of total enrolment, excelled in math. Manitoba and Saskatchewan, the larger of the smaller provinces with a combined 6.5 percent of Canadian enrolment, performed comparatively poorly.

In addition to maintaining high performance levels compared to other G7 members, Canada has a high proportion of socio-economically disadvantaged students who have "beaten the odds" to become high academic performers. Other G7 members have smaller but statistically similar proportions of academically resilient students. Yet no

other G7 country matched Canada's combination of a high reading score and a high academic resilience. Alberta and Ontario surpassed all other provinces and all G7 members in combining these measures of academic excellence and opportunity.

Yet despite Canada's excellent performance, academic achievement has been declining in every province and each subject over time. The decline is least severe in reading where, despite a small but significant drop, the score trajectory at the national level from 2000 to 2018 was classified as "flat" by PISA. Score declines are more severe in math and science, the national trajectories in both domains being classified as "steadily negative." No other G7 country had steadily negative score trajectories in any subject. Among the four largest provinces, score declines are most severe in British Columbia, followed by Alberta, but notably less so in Ontario and Quebec, the small declines in these two largest provinces preventing a larger decline in national scores.

Test results from random samples of students in a single grade can only offer a limited and, it can be argued, shallow account of the accomplishments of schools and school systems, especially in such a diverse country as Canada. Even so, the PISA results are strategically meaningful in that they measure life-relevant knowledge and skills in core school subjects among young people who have completed elementary school around the world. And despite their limitations, the PISA results provide the most comprehensive set of school performance measures that benchmark the performance of Canada's provincial school systems against international standards, including schools in the economically mature and wealthy G7 countries. When investigating the performance of Canada's decentralized school systems in international context, PISA is the only game on the planet.

Even so, the Pan-Canadian Assessment Program provides valuable complementary Canadian data, Unlike PISA, PCAP measures the performance of only Canadian Grade 8 students in reading, math and science using a curriculum-based, rather than an applied knowledge, assessment framework. Nonetheless, there are similar performance rankings among the provinces in the PISA and PCAP results. In the most recent 2019 PCAP data, Ontario and Alberta scored highest in reading, Alberta, PEI and Ontario in science, with Quebec excelling once more in math. Manitoba and New Brunswick once more had the lowest scores in reading; Saskatchewan, Newfoundland and Labrador, and Manitoba in math. New Brunswick, Manitoba and, anomalously, Quebec, scored lowest in science (CMEC, 2021: Tables 2.1, 1.4, 3.1). [16]

This independent support for the relative performance of provincial school systems builds confidence in the PISA findings, and in doing so sharpens the question of whether current provincial performance gaps are acceptable. In reading, there is a 37 score point performance gap in the PISA data between the average scores for Alberta and Manitoba,

[16] Rank-order correlations for provincial PISA18 and PCAP19 scores are: reading (rho = 0.695, p. = .026); math (rho = 0.973, p. = .002), science (rho = 0.406, p. = 0.244 [ns]). Quebec appears as a distorting outlier in a regression of PCAP19 science values on PISA science scores [RStudent = -4.606]. Spearman's rho with Quebec removed is 0.783 p. = 0.13.

and a 42 point gap between average scores for Alberta and New Brunswick. In math the gap between Quebec, with the highest average score, and Saskatchewan and Manitoba with the lowest average scores is 48 and 52 points respectively. Internationally, the performance gaps between the highest and lowest average G7 scores are 44 for reading (Canada-Italy), 49 for math (Japan-USA) and 66 (Japan-Italy) for science. Are performance gaps between provinces which are similar to those between G7 countries reasonable and acceptable? Expressed differently, is an average performance gap between the provinces that approximates half of PISA's standardized standard deviation score reasonable and acceptable? The question is sharpened even more in the case of proportions of low achievers, with close to twice as many students achieving at the lowest levels in the lower scoring provinces.

Canada's decentralized school systems can be viewed as education policy laboratories. As such, it is only to be expected that some provinces will outperform others. Given the well-established relationship between socio-economic household circumstances and school success, a strong positive correlation between provincial SES and average student performance is also to be expected. Yet if our provincial school systems were actually treated as policy laboratories, successes in the best performing systems could reasonably be expected to guide improvements in others. The outstanding international success of Alberta in reading and science and Quebec in math offer clear promise for improvements in other systems. One important lesson from the PISA project is that increased financial expenditure in well-established and already well-resourced school systems is unlikely, by itself, to produce improvement (OECD, 2020: 97–98; Krieg, 2019). Resources need to be allocated sensibly and strategically. Easily and often said, but difficult to do without due attention to pertinent research.

Comprehensive and comparable performance and contextual data such as that generated through the PISA project is indispensable when pursuing this goal. The rich contextual measures of school operations and resources available in the PISA data will prove particularly useful in this endeavour, and can be related to and augmented by domestic data from PCAP and appropriate provincial assessments.

In the shorter term, the results of the next PISA assessment will be available in 2023, after being postponed for a year due to COVID-19. In addition to reflecting the effects of the COVID mitigation measures differentially imposed on schools around the globe and within Canada, the pressing questions for Canada will be whether subject scores continue to decline, and whether the performance gaps between the provinces increase.

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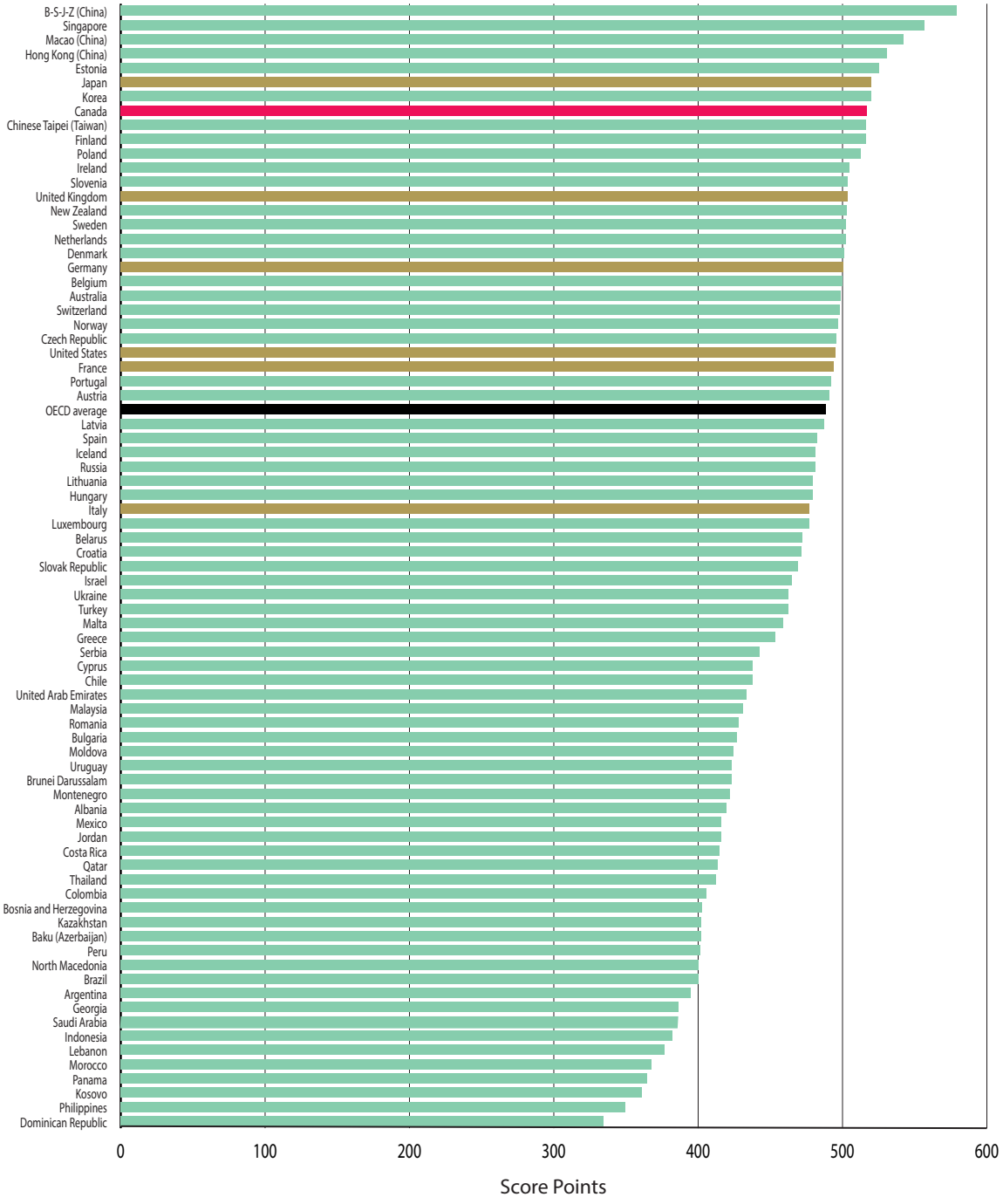
Appendix A

Average of three subject means for G7 and all other national systems participating in PISA 2018

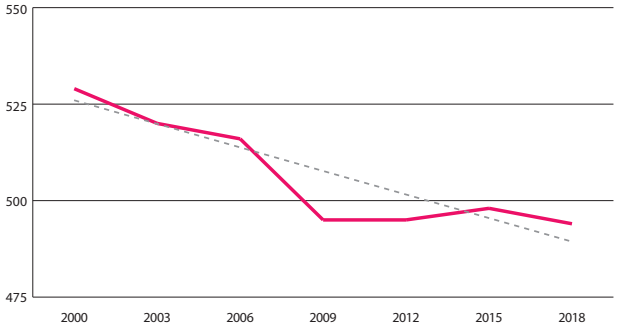


Source: OECD (2019a): Tables I.B1.4, I.B1.5, I.B1.6; author's calculations.

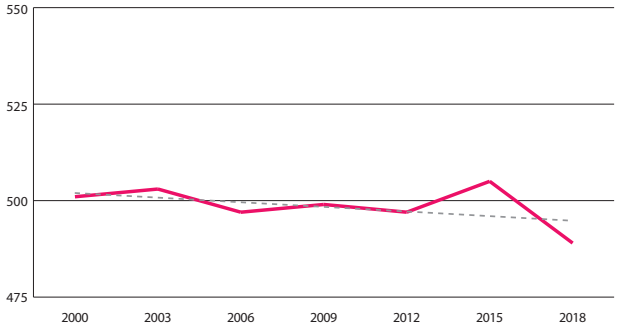
Appendix B

Trends in subject means for Smaller Six provinces

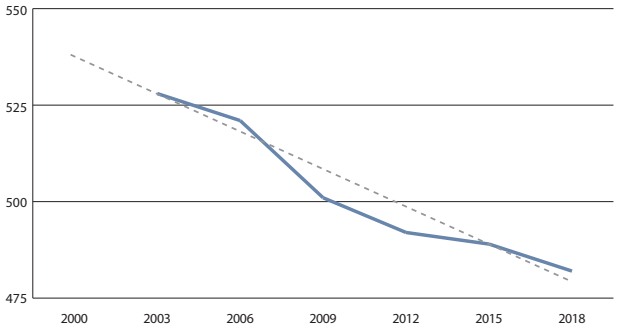
Manitoba

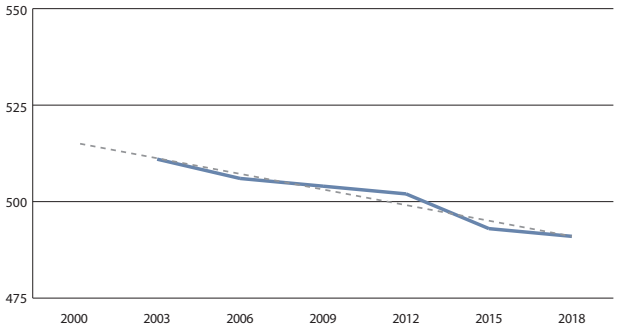


New Brunswick

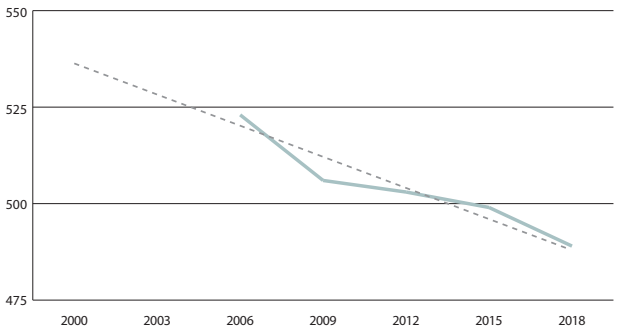


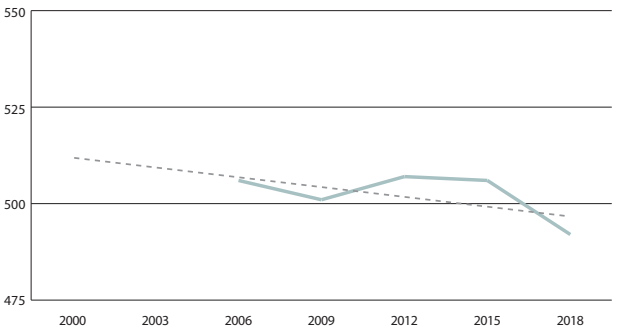
Reading





Math

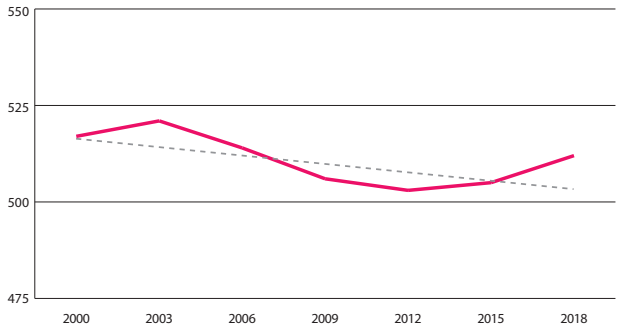




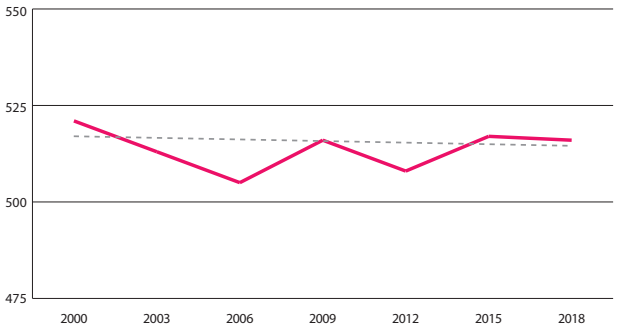
Science

Appendic B, continued: Trends in Subject Means for Smaller Six Provinces

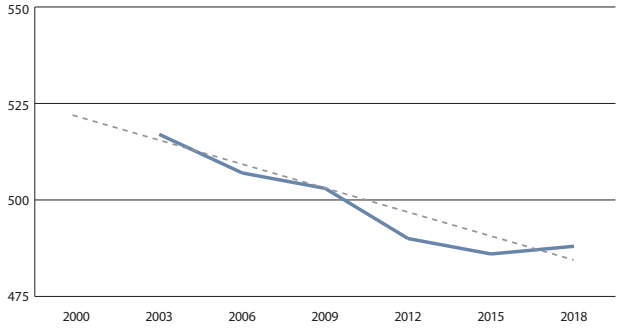
Newfoundland and Labrador

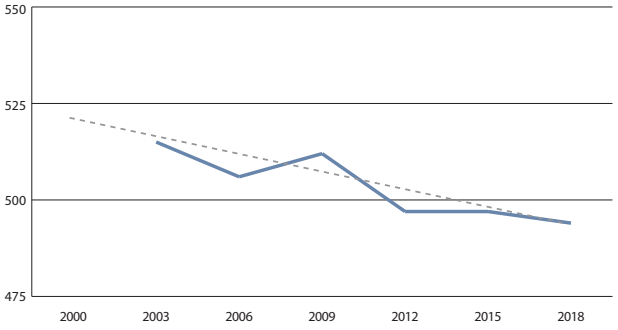


Nova Scotia

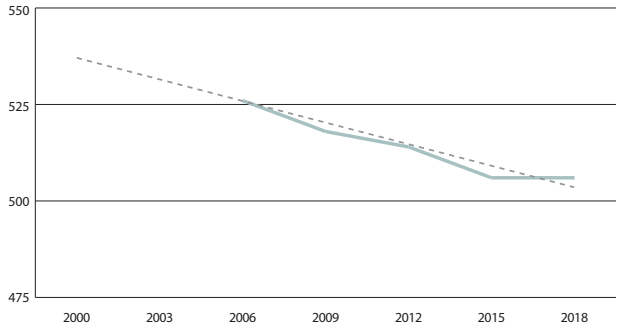


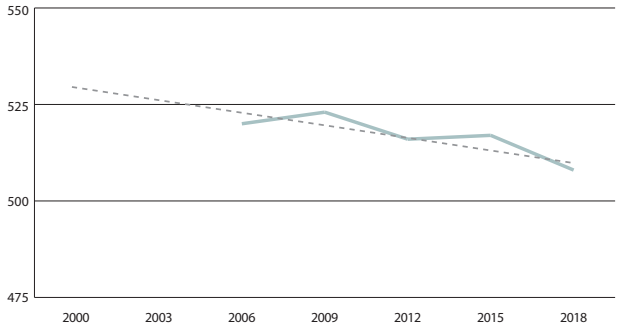
Reading





Math

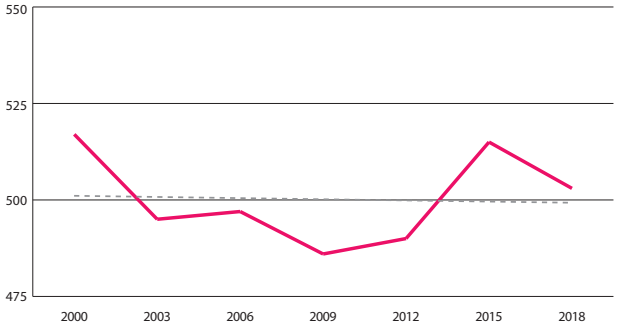




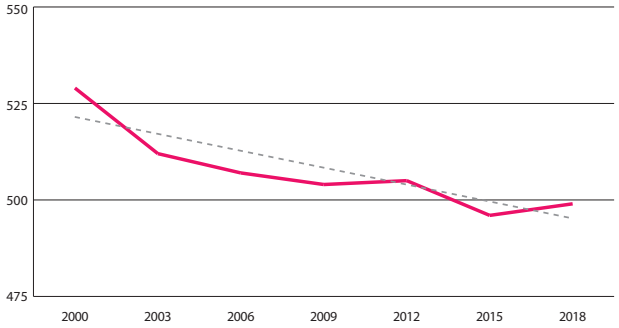
Science

Appendic B, continued: Trends in Subject Means for Smaller Six Provinces

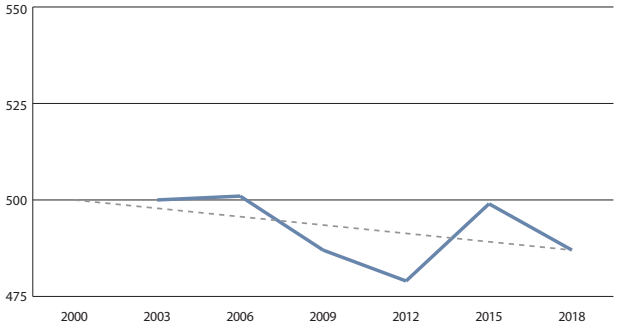
Prince Edward Island

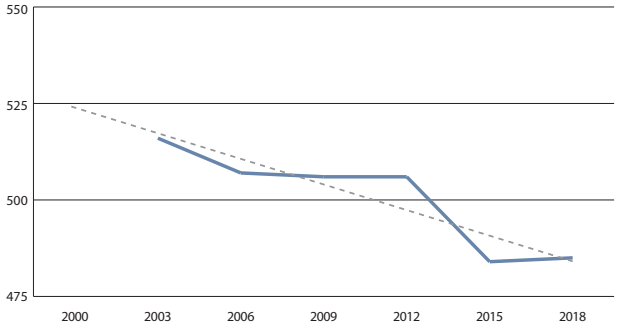


Saskatchewan



Reading





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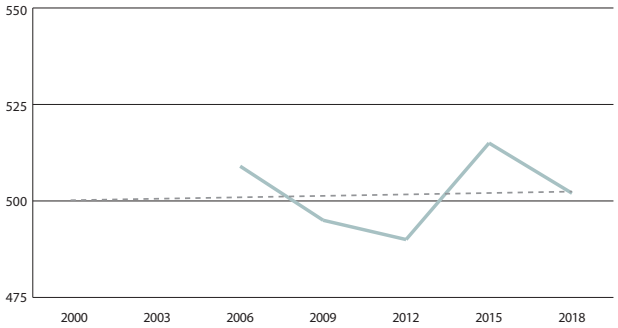

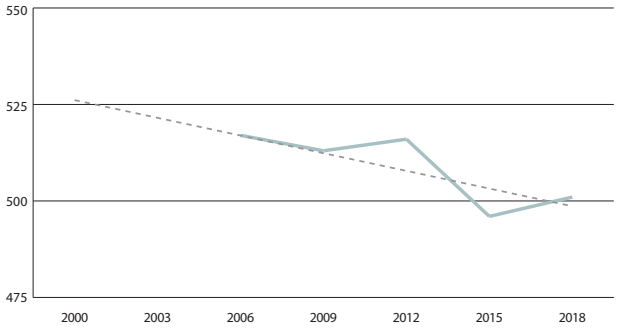

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Source: Statistics Canada (2020): Table 37-10-0149-01.

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Derek J. Allison, B.Ed., M.Ed., Ph.D., is a Professor Emeritus in the Faculty of Education at the University of Western Ontario and a Fraser Institute senior fellow. Derek began his teaching career in England, before moving to Alberta, where he was a school principal. After completing his graduate work at the University of Alberta, he accepted a position with the faculty of education at the University of Western Ontario, where he taught social and legal foundations of education for 36 years, and skillfully guided hundreds of graduate students through advanced research and study. He gained acclaim for his teaching, especially his outstanding lectures, and his skill as a mentor and advisor to graduate students. He has an extensive record in research and publication with particular interests in the organization and operation of schools, theories of leadership, and the philosophy of inquiry. He is the recipient of 10 teaching awards and the Distinguished Service Award of the Canadian Association for the Study of Educational Administration.

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