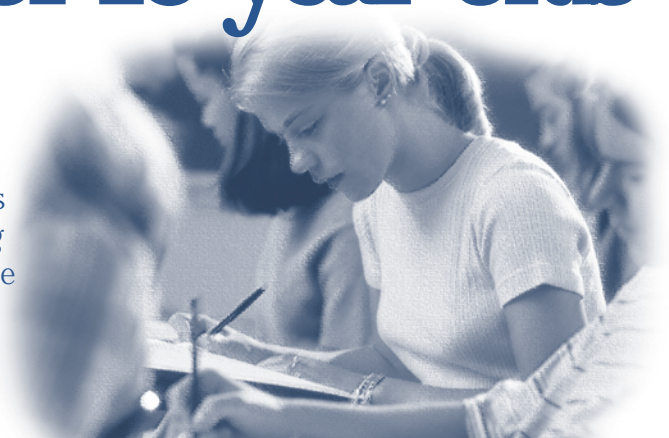


# Provincial variation in reading scores of 15-year-olds

by J. Douglas Willms

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**T**oday, more than ever before, literacy skills are essential for participation in the labour market, and are a precursor to an individual's long-term health and well-being. The demand for these skills has been steadily increasing, and is likely to continue to do so over the next decade. Earlier research has also shown that young people with strong literacy skills are more likely to enter postsecondary education and have better employment opportunities and higher wages when they enter the labour market.<sup>1</sup>

This article uses data from the 2000 Organisation for Economic Co-operation and Development (OECD) Programme for International Student Assessment (PISA) to examine the variation between Canada's provinces in the literacy skills of 15-year-old students; it also looks at family background and school factors as potential explanations for these differences.

## CST What you should know about this study

The Programme for International Student Assessment (PISA) is a collaborative effort among member countries of the Organisation for Economic Co-operation and Development (OECD) to regularly assess the achievement of 15-year-olds in three domains—reading literacy, mathematical literacy and scientific literacy—through a common international test. Thirty-two countries participated in PISA 2000. In Canada, approximately 30,000 15-year-old students from more than 1,000 schools took part, a large sample to enable reliable national and provincial estimates. The PISA 2000 survey included a direct assessment of students' skills through reading, mathematics and science tests, as well as questionnaires collecting background information from students and school principals.

In PISA, reading literacy is defined as the ability to understand, use and reflect on written texts in order to achieve one's goals, to develop one's knowledge and potential, and to participate effectively in society. PISA 2000 used about 140 items representing the kinds of reading literacy tasks that 15-year-olds may require in the future. The reading score assigned to students was designed to average 500 across all OECD countries, with about two-thirds of students in OECD countries scoring between 400 and 600 points. In Canada, the average reading score was 534 and about two-thirds of students scored between 439 and 629.

Students' reading score was related to their socioeconomic status. The PISA index of socioeconomic status (SES) included several measures describing economic, social and cultural aspects of students' families. It was measured using a statistical composite of parental education, parental occupational status, educational resources in the home, family wealth (based on household possessions) and classical cultural possessions.<sup>1</sup>

1. The PISA index of possessions related to “classical” culture in the family home were derived from the availability of the following items in the home: classical literature, books of poetry and works of art.

## Reading performance varies among provinces

The average score of Canadian students on the PISA reading test was 534, just 12 points below that of Finland, the highest-scoring country. The average scores by province varied from a low of 501 in New Brunswick, very close to the OECD average, to 550 in Alberta, comparable to that of Finland. The average scores for the three largest provinces, Ontario, Quebec and British Columbia, were 533, 536 and 538, respectively. Because almost three-quarters of all 15-year-old students live in these three provinces, their reading performance anchors the Canadian average of 534.

Not all 15-year-olds are in the same grade, so an analysis of grade and reading score differences can help in understanding how much of a reading score change may be associated with a difference of one grade. This may put the provincial variations into perspective, although the variations are not solely attributable to the grade difference, but also to a difference in accumulated learning and skill development that has occurred since birth. A difference of one grade makes an estimated average 34-point difference in the reading score; in other words, a one-point difference might be worth about five school days.

## Socioeconomic status is one factor associated with reading performance

Compared to the OECD median, Canada has a higher median socioeconomic score (SES) and a narrower range of SES scores. Canadian students scored above the OECD average in reading at all SES levels, but this lead was slightly greater for low SES students, suggesting that Canada does well in developing the literacy of youth from less advantaged circumstances. Yet, a large performance gap still exists between students from low and high socioeconomic backgrounds. For example, a typical student at the bottom 5%

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## Students in Alberta scored highest on the reading performance test

	Average reading score (unadjusted)	Average reading score (adjusted for socioeconomic status of students)
<b>Canada</b>	<b>534</b>	<b>527</b>
<b>Province</b>		
Newfoundland and Labrador	517	513
Prince Edward Island	517	518
Nova Scotia	521	515
New Brunswick	501	503
Quebec	536	539
Ontario	533	519
Manitoba	529	526
Saskatchewan	529	529
Alberta	550	535
British Columbia	538	528

Source: Organisation for Economic Cooperation and Development, Programme for International Student Assessment, 2000.

point of the SES scored about 479 in reading literacy, while a typical student at the top 5% point scored around 580.

While a student's socioeconomic background is a factor in explaining reading score variation, only some of the variation in reading performance between provinces is attributable to socioeconomic status. After adjusting for the effects of SES, the adjusted average reading scores were not much different in six of the provinces, but they were lower than the unadjusted scores by 6 to 15 points in Nova Scotia, Ontario, Alberta and British Columbia. After accounting for the socioeconomic status of students, there is still a substantial variation in reading scores between provinces—from 503 in New Brunswick to 539 in Quebec—indicating that other factors are also at work.

## Reading performance of schools varies substantially even after accounting for students' family background

For the PISA survey in Canada, schools were sampled and 15-year-

old students were chosen within the selected schools. Characteristics of schools and their policies and practices were collected to enable exploration of the relationship between the average reading performance and school characteristics, practices, resources and policies.

There is a substantial variation between schools in the reading performance of their students even after accounting for differences in family background. In every province, reading scores for schools with average SES intake range from 50 to 100 points between the highest and the lowest performing schools. Some of these average SES schools score at or above the Canadian average, and some are among the top scoring ones in the OECD study.

In some national and provincial assessments, the relatively low performance of some schools was linked to the low socioeconomic background of students attending them. But according to PISA, many schools with low SES intakes have exceptionally high performance, while others with high SES have

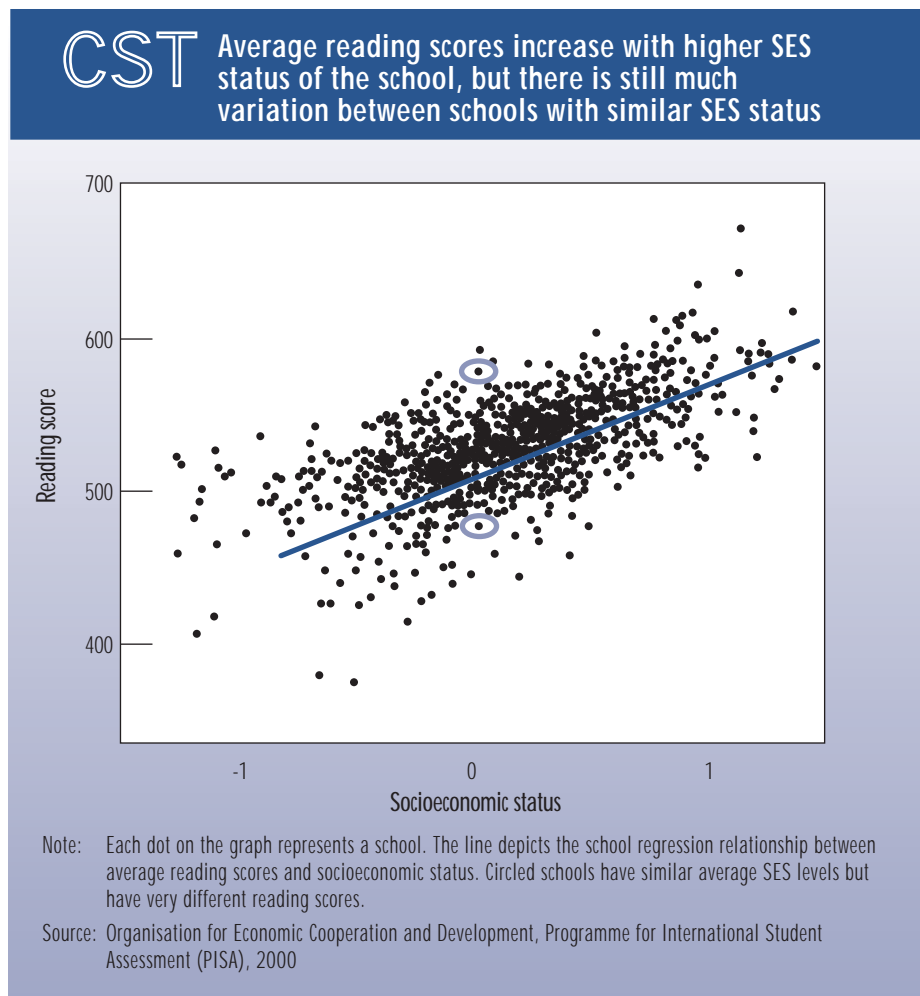
relatively low performance. Clearly then, there are exemplary schools in every province, including ones that serve students from a range of socioeconomic backgrounds.<sup>2</sup>

### Students from less advantaged families do better in a high SES school

To understand which factors influence reading scores, a model including factors such as family background of students, school context<sup>3</sup> and school process<sup>4</sup> was developed. This model showed that, on average, an increase of one standard deviation<sup>5</sup> in student socioeconomic status is associated with a 28-point increase in reading performance. In addition, a number of studies have found that the average level of school SES has an effect on student performance over and above the effects already associated with a student's individual level of SES.<sup>6</sup>

According to PISA data, if a student with average family background attended a school with a high SES (half a standard deviation above the OECD average), rather than one with a low SES (half a standard deviation below the OECD average), the student's expected reading performance would be 41 points higher. Students from less advantaged families tended to perform considerably worse if they attended a low SES school than if they attended a high SES school. The same applies for students from high SES families, but the effect was not as pronounced. This suggests that when schools differ substantially in their average socioeconomic intake, the disparities in their reading performance increase.

The differences in reading performance between students from differing SES backgrounds are less pronounced in high SES schools than in low SES schools.<sup>7</sup> For example, if two students—one high SES and one low SES—attended the same school, the expected reading performance gap between them would be 25



points in a high SES school and 31 points in a low SES school. This is called triple jeopardy because youth from low SES families have lower reading performance, they have lower scores if they attend low SES schools, and the effect is particularly pronounced if a low-SES student attends a low-SES school.

Accounting for family background, school context and school processes, girls outperformed boys on the reading test by 34 points. Foreign-born 15-year-olds scored 25 points lower than Canadian-born 15-year-olds, after accounting for other factors. This result is not too alarming since earlier research suggests that the literacy gap for foreign-born residents decreases sharply during the first 10 years they are in the country.<sup>8</sup>

Other school-related factors also influence reading scores. The analysis

shows that larger schools perform slightly better on average than small schools: an increase in school size of 100 students is associated with an increase in reading performance of 2 points. However, reading performance declines in schools beyond an optimal school size. Schools where the teachers had specialized training in language arts also scored slightly higher: on average, a 10-percentage point increase in the percentage of specialized teachers was associated with a 1.5-point increase in reading scores. The quality of school infrastructure and the availability of school computers for students were not significant. However, in schools where students made better use of resources, reading scores were higher. Factors pertaining to school policy and practice had no significant effect, except for teacher autonomy.

Two of the measures of classroom practice were also significant factors. A one-point increase on the teacher-student relations scale was associated with a 2.3 point increase in reading performance, while a one-point increase in the disciplinary

climate scale was associated with a 2.6 point increase in performance.

### Provincial reading scores differ for many reasons

The variation in average provincial reading scores is related to many

factors. After accounting for family background or student characteristics such as gender, socioeconomic status and immigration status, those provinces with higher SES scores (Ontario, Alberta, British Columbia) saw their reading scores adjusted downward, while those with lower SES scores (Newfoundland and Labrador, Prince Edward Island, New Brunswick) saw their average reading scores adjusted upward. About 40% of the variation in provincial performance was attributable to differences in family background.

Accounting for the effect of the average SES of schools further reduced the variation between provinces: 63% of the variation in provincial performance was associated with family background and school context combined. Finally, controlling for school process such as school resources, school policy and practice, and classroom practices implies that provinces with high scores on the measures of school process will see their scores decline (Quebec, Alberta, British Columbia) while those with low scores will see them increase (Prince Edward Island, New Brunswick).

After controlling for all of these factors, the average reading scores in eight provinces turn out to be quite similar. This analysis permits an understanding of some of the factors contributing to variations in reading scores between provinces. For example, Quebec's average reading performance was high because it had disproportionately more schools with students of average socioeconomic background scoring in the top range. In contrast, Alberta's average reading performance was relatively high partly because its student population came from a comparatively advantaged background and partly because of positive school policies and practices. Ontario's higher performance was due largely to relatively high socioeconomic status, as well as positive classroom policies and practices.

## CST The socioeconomic status of students and schools are associated with differences in reading scores

Model coefficients for reading scores controlling for family background, school context and school processes

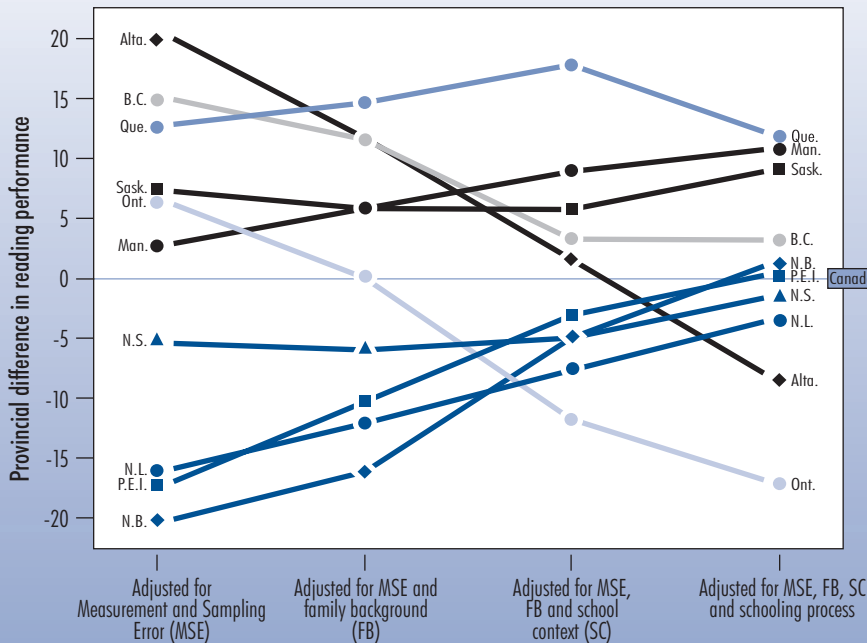
	Model coefficients for reading scores controlling for family background, school context and school processes
Reading score mean	508.7
<b>Family background and student characteristics</b>	
Socioeconomic status (student-level)	<b>27.9</b>
Female	<b>34.2</b>
Foreign-born	<b>-24.6</b>
<b>School context</b>	
Socioeconomic status (school level)	<b>40.8</b>
Socioeconomic slope (indicates extent of inequality attributable to SES)	<b>-6.5</b>
Female-male performance gap	-6.8
<b>School processes</b>	
<b>School resources</b>	
Student-staff teaching ratio (unit is 1 student)	-0.2
School size (unit is 100 students)	<b>2.1</b>
School size squared (school is larger than optimal size)	<b>-0.1</b>
Students access to school computers (unit is 10%)	1.4
Teachers have specialized training in language arts (unit is 10%)	<b>1.5</b>
Teachers get professional development (unit is 10%)	-0.4
Quality of school infrastructure <sup>1</sup>	-0.3
Students' use of resources <sup>1</sup>	<b>2.6</b>
<b>School policy and practice</b>	
Conduct formal assessment <sup>1</sup>	0.2
Quality of teaching staff (administrators assessment <sup>1</sup> )	-0.1
Teacher morale <sup>1</sup>	-0.1
Teacher autonomy <sup>1</sup>	<b>0.5</b>
Principal autonomy <sup>1</sup>	0.1
<b>Classroom practice</b>	
Conduct informal assessment <sup>1</sup>	-0.4
Teacher-student relations <sup>1</sup>	<b>2.3</b>
Disciplinary climate <sup>1</sup>	<b>2.7</b>
Achievement pressure <sup>1</sup>	0.0

Note: Bold numbers are statistically significant at  $p < 0.05$  level. Many of the school scales used in the model are described in Appendix A of Organisation for Economic and Cooperation and Development. 2001. *Knowledge and skills for life: First results from the OECD Programme for International Student Assessment (PISA) 2000*. Paris: OECD. [www.oecd.org](http://www.oecd.org) (accessed September 2004).

1. This school-level variable was scaled on a 10-point scale, ranging from zero to 10 representing a school's position relative to other schools in the OECD. For example, a score of 3.4 on the 10-point scale indicates that the school's score was at the 34<sup>th</sup> percentile among all OECD schools.

Source: Organisation for Economic Cooperation and Development, Programme for International Student Assessment, 2000.





Source: Organisation for Economic Cooperation and Development, Programme for International Student Assessment, 2000.

1. Raudenbush, S.W. and R. Kasim. 1998. "Cognitive skill and economic inequality: Findings from the National Adult Literacy Survey." *Harvard Educational Review*, 68, 1: 33-79.
2. There is also a wide range of school SES scores in Canada. In fact, nearly 20% of schools have an average socioeconomic status score, similar to the average SES of schools in Greece, Latvia and Spain. About 8% of schools have an SES average score equivalent to the average school in the Russian Federation and below that of Portugal and Poland.
3. School mean of SES was used as a proxy for the factors associated with school context.
4. "School process" covers three categories of school-related factors — school resources, school policy and practice and classroom practice. School resources include student-staff teaching ratio, school size, computers in schools, teachers with specialized training in language arts, teachers involved in professional development programs, quality of the school infrastructure and students' use of school resources such as the school library, calculators, labs, the Internet. School policies and practices include formal assessments indicating the frequency of use of standardized tests; quality of the teaching staff as assessed by the school administrator; teacher morale; teacher autonomy and principal autonomy. Classroom practices include measures of informal assessment indicating the frequency of use of tests developed by teachers, teachers' judgmental ratings, and assessments based on student portfolios, assignments, projects and homework; student-teacher relations; disciplinary climate and achievement pressure.
5. Standard deviation is a commonly used measure of variation or spread of values around their average.
6. Willms, J.D. 1999. "Quality and inequality in children's literacy: The effects of families, schools and communities". In D. Keating and C. Hertzman (eds.), *Developmental Health and the Wealth of Nations: Social, Biological and Educational Dynamics*. p. 72-93. New York: Guilford Press.
7. Negative coefficient for socioeconomic slope under school context indicates this.
8. Willms, J.D. 1999. *Inequalities in Literacy Skills among Youth in Canada and the United States* (Statistics Canada Catalogue no. 89F0116XIE). Statistics Canada, Human Resources Development Canada and National Literacy Secretariat.

**Summary**

Differences in reading performance among schools, provinces or countries are the result of several factors that contribute to children's development from birth. Therefore, average scores may reflect the quality of care and stimulation provided to children during infancy and the pre-school years, and the opportunities children have to learn both in school and at home during the elementary and secondary school years.

Some of the variation among schools and provinces in their reading performance is attributable to school resources, policies and practices and classroom practices. It is not possible to identify one or two factors that explain most of the reading score variation among schools or provinces. Higher and less variable outcomes are associated with a broad set of classroom and school factors.

The most important school resource factor for reading performance is whether students were taught by teachers trained in language arts. In addition, two aspects of classroom practice emerged as contributing to higher performance: better teacher-student relations and a strong disciplinary climate. Several factors, including family background, school context and school processes, contribute to the differences in average reading scores between the provinces.



**J. Douglas Willms** is a professor in the Faculty of Education, Director of the Canadian Research Institute for Social Policy, and holds the Canada Research Chair in Human Development at the University of New Brunswick.