

**SCHOOL ACHIEVEMENT INDICATORS PROGRAM
COUNCIL OF MINISTERS OF EDUCATION, CANADA**

**Québec Results
in the 1999 Science Assessment**

Québec 

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Ministère de l'Éducation
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1. CONTEXT OF THE STUDY

The provinces of Canada have given the Council of Ministers of Education, Canada (CMEC), the mandate to implement the School Achievement Indicators Program (SAIP) to assess students' performance in mathematics, reading and writing, and science. In April 1999, the science achievement of students from all the provinces and territories of Canada was assessed.

Target Groups

The 1999 science assessment was administered to students who were 13 or 16 years old on August 31, 1998. These two age groups were selected for the following reasons: the group of 16-year-olds consisted mainly of students in their last year of compulsory school attendance; the group of 13-year-olds consisted of students, in most of the provinces' education systems, in the first year of secondary school, which is the transition year between elementary and secondary school.

Assessment Instruments

The assessment focused on the understanding of science concepts (**written assessment**) and science inquiry skills (**practical tasks**). Each student in the sample was administered only one of the two assessment instruments.

Comparability of the Results of Anglophones and Francophones

The development team—comprising science specialists from Newfoundland, Nova Scotia (French sector), Québec, Ontario and Saskatchewan—worked with the provinces in order to develop equivalent assessment instruments in the two official languages.

Comparability of 1996 and 1999 Results

Some changes were made to the 1996 instruments for the 1999 assessment. In the written assessment, the items were grouped in one booklet divided into three sections, rather than in three separate booklets. For the practical tasks, some questions involving three of the seven practical tasks and the laboratory material for certain tasks were changed. Some modifications were also made to the correction procedure for the practical tasks. Therefore, the results of the 1996 and 1999 written assessments may be compared, but it would be more problematic to compare the results of the practical tasks.

Description of Performance Levels

Students' science achievement was evaluated in terms of five levels of performance. Level 1 corresponds to the learning expected of students in elementary school, whereas level 5 describes the performance expected of students who have completed an advanced course in science. Thus, it was expected that most students in the target groups for the assessment would easily attain performance level 1 and that very few 13-year-olds and few 16-year-olds would meet the criteria for level 5.

2. QUÉBEC RESULTS

Table 1 shows the size of the Québec samples in the study. More than 5 000 13-year-olds and 16-year-olds took part. About 5 per cent of the 16-year-olds were studying at the college level.

In the case of both the 13-year-olds and the 16-year-olds, the samples for the written assessment are representative of Québec's student population because they consist of students from both the public and private systems as well as both linguistic groups, francophones and anglophones. For the 1999 practical tasks, a sufficient sample of 16-year-old anglophones and francophones, representative of Québec's student population, was constituted to allow Québec results for this age group to be published.

Table 1
NUMBER OF STUDENTS IN THE SAMPLES

Sample	Francophones	Anglophones	Total
13-year-olds			
Written assessment	984	905	1889
Practical tasks	381	104	485
16-year-olds			
Written assessment	1016	928	1944
Practical tasks	677	147	824
Total number of students	3058	2084	5142

3. QUÉBEC RESULTS IN THE WRITTEN ASSESSMENT

Students were classified in five levels of performance following the marking of the assessment, which evaluated the students in the following areas:

- knowledge and concepts of science
- nature of science
- relationship of science to technology and societal issues

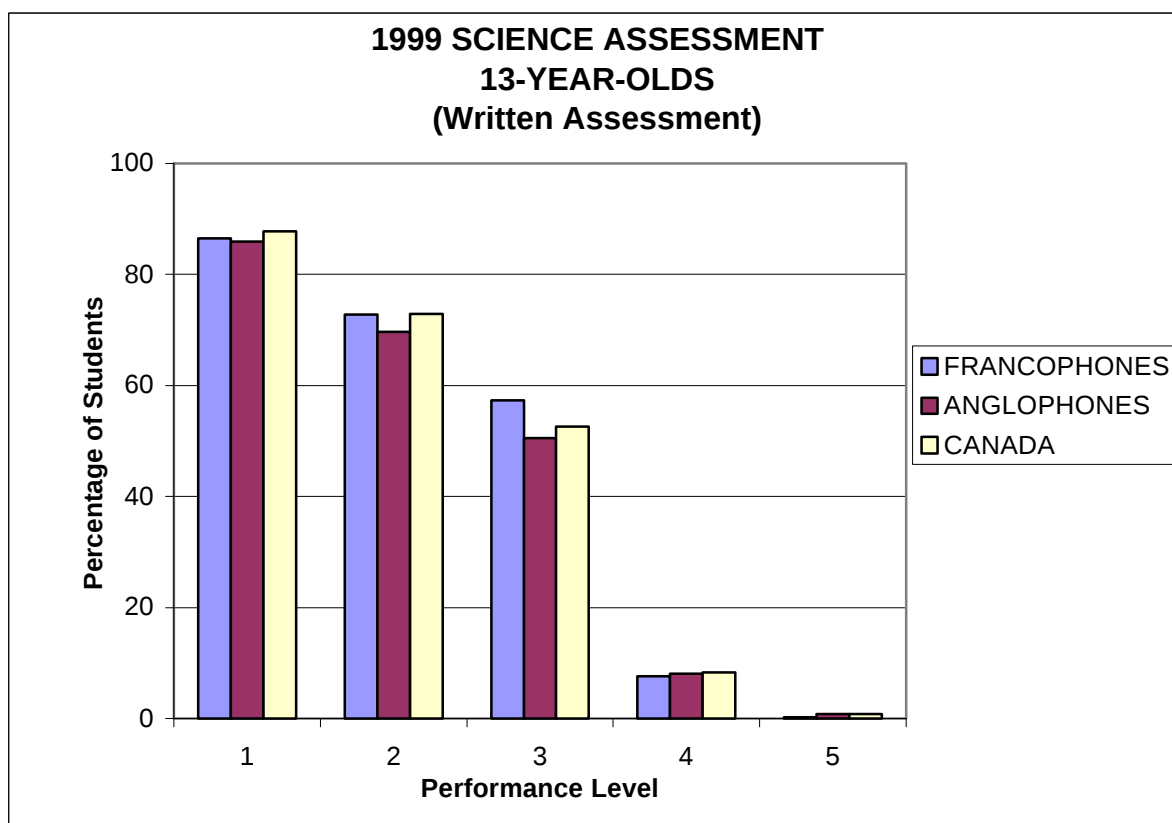
The questions dealt with conceptual knowledge and understanding, procedural knowledge and problem solving in science. A description of the five levels of performance is provided in Appendix A.

Table 2 shows the percentages of Québec students attaining each level of performance in the understanding of science concepts. The results for 13-year-olds and 16-year-olds are provided for anglophones and francophones.

- **Level 1** is attained by about nine out of ten 13-year-olds and almost all 16-year-olds.
- **Level 2** is attained by about seven out of ten 13-year-olds and about nine out of ten 16-year-olds.
- **Level 3** clearly differentiates the 13-year-olds from the 16-year-olds. There is a difference of more than 25 points between the results of the two age groups. Five out of ten 13-year-olds attain this level, while eight out of ten 16-year-olds do so.
- **Level 4** is attained by fewer than one out of ten 13-year-olds and by about three out of ten 16-year-olds. There is a difference of more than 20 points between the results of the two age groups.
- **Level 5** is attained by very few 13-year-olds and a few 16-year-olds.

**PERFORMANCE OF ANGLOPHONE AND FRANCOPHONE STUDENTS
— SCIENCE CONCEPTS —
(WRITTEN ASSESSMENT)**

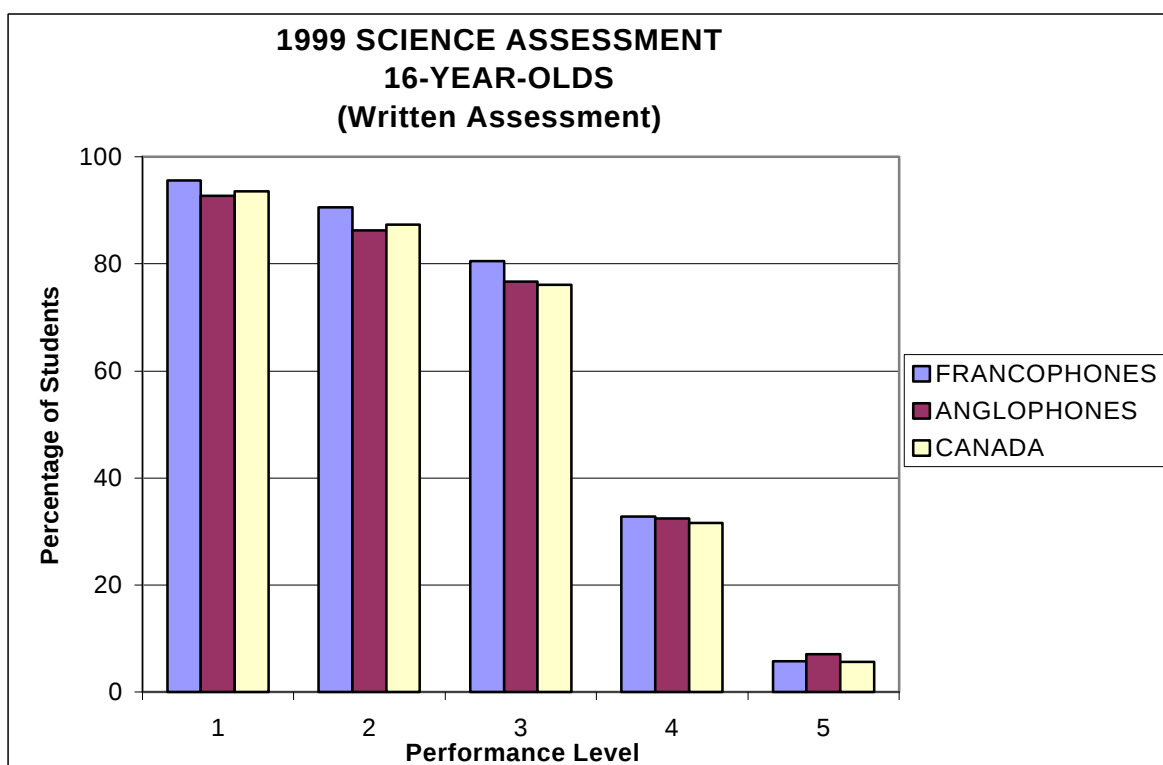
Results of 13-Year-Olds by Language of Instruction					
	Performance Level (by %)				
Population	1	2	3	4	5
Francophones (1999)	86.5 ± 2.1	72.8 ± 2.8	57.3 ± 3.1	7.6 ± 1.7	0.3 ± 0.3
Anglophones (1999)	85.9 ± 2.3	69.6 ± 3.0	50.5 ± 3.3	8.1 ± 1.8	0.8 ± 0.6
Canada (1999)	87.8 ± 0.6	72.9 ± 0.8	52.6 ± 0.9	8.3 ± 0.5	0.8 ± 0.2
<i>Francophones (1996)</i>	<i>91.1 ± 1.7</i>	<i>73.3 ± 2.6</i>	<i>48.4 ± 3.0</i>	<i>5.2 ± 1.3</i>	<i>0</i>
<i>Anglophones (1996)</i>	<i>90.5 ± 1.8</i>	<i>72.6 ± 2.8</i>	<i>43.0 ± 3.1</i>	<i>5.0 ± 1.4</i>	<i>0.2 ± 0.3</i>
<i>Canada (1996)</i>	<i>88.8 ± 0.5</i>	<i>71.9 ± 0.8</i>	<i>43.0 ± 0.8</i>	<i>5.5 ± 0.4</i>	<i>0.3 ± 0.1</i>



The confidence levels indicated in the table must be considered before it is concluded that the results are statistically different.

Table 2b
PERFORMANCE OF ANGLOPHONE AND FRANCOPHONE STUDENTS
— SCIENCE CONCEPTS —
(WRITTEN ASSESSMENT)

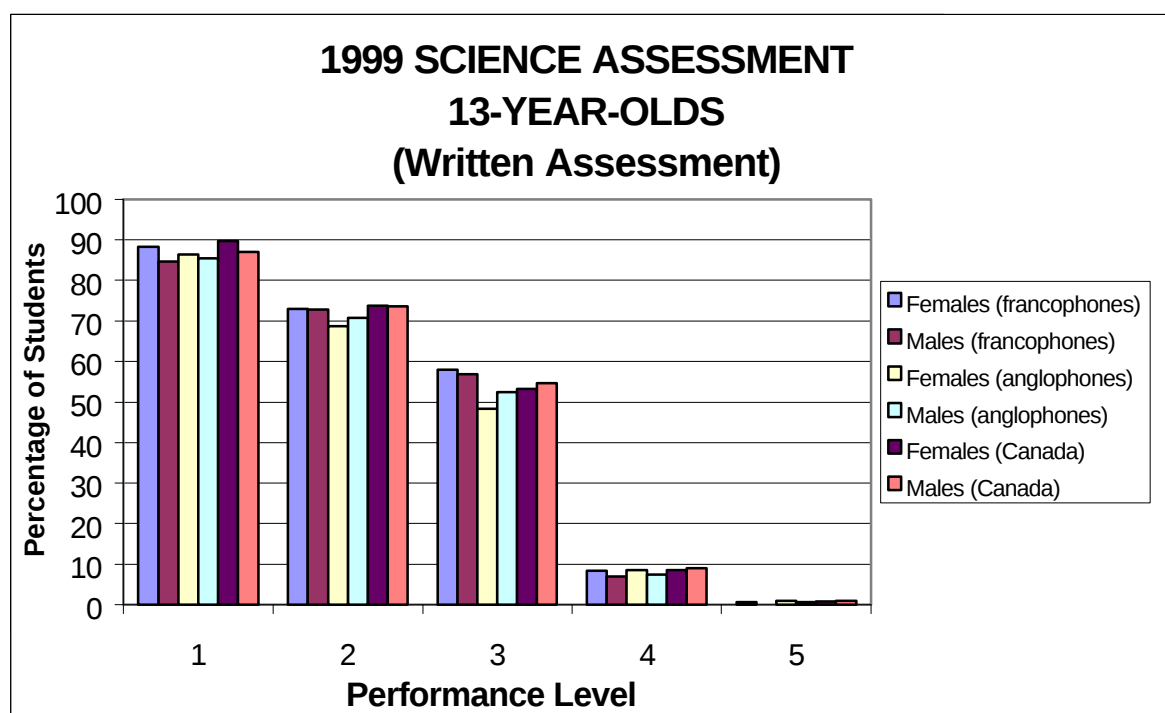
Results of 16-Year-Olds by Language of Instruction					
	Performance Level (by %)				
Population	1	2	3	4	5
Francophones (1999)	95.6 ± 1.3	90.6 ± 1.8	80.5 ± 2.4	32.8 ± 2.9	5.7 ± 1.4
Anglophones (1999)	92.7 ± 1.7	86.3 ± 2.2	76.7 ± 2.7	32.4 ± 3.0	7.0 ± 1.6
Canada (1999)	93.6 ± 0.4	87.3 ± 0.6	76.1 ± 0.8	31.6 ± 0.8	5.6 ± 0.4
<i>Francophones (1996)</i>	<i>96.2 ± 1.1</i>	<i>90.3 ± 1.7</i>	<i>73.4 ± 2.6</i>	<i>28.6 ± 2.6</i>	<i>1.7 ± 0.7</i>
<i>Anglophones (1996)</i>	<i>95.4 ± 1.3</i>	<i>85.2 ± 2.2</i>	<i>65.6 ± 3.0</i>	<i>21.2 ± 2.6</i>	<i>3.5 ± 3.2</i>
<i>Canada (1996)</i>	<i>95.0 ± 0.4</i>	<i>87.6 ± 0.6</i>	<i>69.0 ± 0.8</i>	<i>26.1 ± 0.8</i>	<i>3.4 ± 0.3</i>



The confidence levels indicated in the table must be considered before it is concluded that the results are statistically different.

Table 3a
PERCENTAGE OF ANGLOPHONE AND FRANCOPHONE STUDENTS
AT EACH PERFORMANCE LEVEL
— SCIENCE CONCEPTS —
(WRITTEN ASSESSMENT)

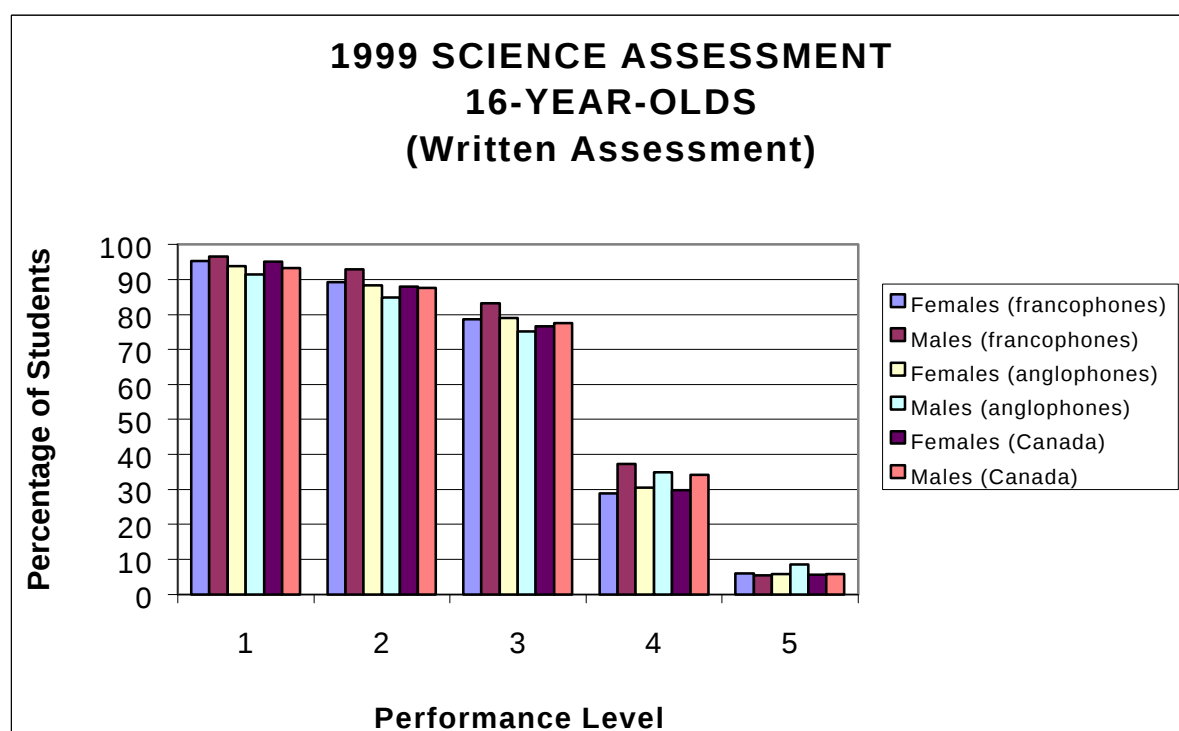
Results of 13-Year-Olds by Gender					
	Performance Level (by %)				
Population	1	2	3	4	5
Females (francophones)	88.3 ± 3.3	73.0 ± 3.2	57.9 ± 4.5	8.3 ± 2.4	0.6 ± 0.7
Males (francophones)	84.7 ± 2.8	72.8 ± 3.2	56.9 ± 4.3	7.0 ± 2.2	0.0 ± 0.0
Females (anglophones)	86.4 ± 3.6	68.7 ± 3.8	48.4 ± 4.6	8.5 ± 2.5	0.9 ± 0.9
Males (anglophones)	85.4 ± 3.2	70.7 ± 3.5	52.5 ± 4.5	7.4 ± 2.3	0.6 ± 0.7
Females (Canada)	89.7 ± 0.8	73.8 ± 1.1	53.2 ± 1.3	8.5 ± 0.7	0.8 ± 0.2
Males (Canada)	87.0 ± 0.8	73.6 ± 1.1	54.6 ± 1.2	9.1 ± 0.7	0.9 ± 0.2



The confidence levels indicated in the table must be considered before it is concluded that the results are statistically different.

Table 3b
PERCENTAGE OF ANGLOPHONE AND FRANCOPHONE STUDENTS
AT EACH PERFORMANCE LEVEL
— SCIENCE CONCEPTS —
(WRITTEN ASSESSMENT)

Results of 16-Year-Olds by Gender					
	Performance Level (by %)				
Population	1	2	3	4	5
Females (francophones)	95.2 ± 1.9	89.3 ± 2.6	78.6 ± 4.1	28.9 ± 3.5	5.9 ± 1.9
Males (francophones)	96.5 ± 1.7	92.9 ± 2.8	83.2 ± 4.6	37.3 ± 4.3	5.4 ± 2.1
Females (anglophones)	93.8 ± 2.1	88.2 ± 2.6	79.0 ± 4.5	30.4 ± 3.9	5.8 ± 2.1
Males (anglophones)	91.4 ± 2.3	84.9 ± 2.8	75.1 ± 4.5	34.8 ± 4.1	8.5 ± 2.6
Females (Canada)	95.1 ± 0.8	87.9 ± 0.8	76.5 ± 1.1	29.8 ± 1.2	5.6 ± 0.6
Males (Canada)	93.2 ± 0.9	87.6 ± 0.9	77.5 ± 1.1	34.1 ± 1.3	5.7 ± 0.6



The confidence levels indicated in the table must be considered before it is concluded that the results are statistically different.

4. QUÉBEC RESULTS IN THE PRACTICAL TASK ASSESSMENT

Science inquiry skills are used to solve problems. These skills facilitate the application of scientific knowledge to a variety of scientific, technological and societal issues.

Students participating in the science inquiry skills assessment were asked to perform seven tasks that required them to collect and analyze their own data. The tasks used to assess science inquiry skills required students to:

- identify questions that are, or should be, investigated
- carry out procedures
- select and use proper equipment and materials
- identify variables and controls in an experiment
- organize, interpret and communicate data
- design experiments

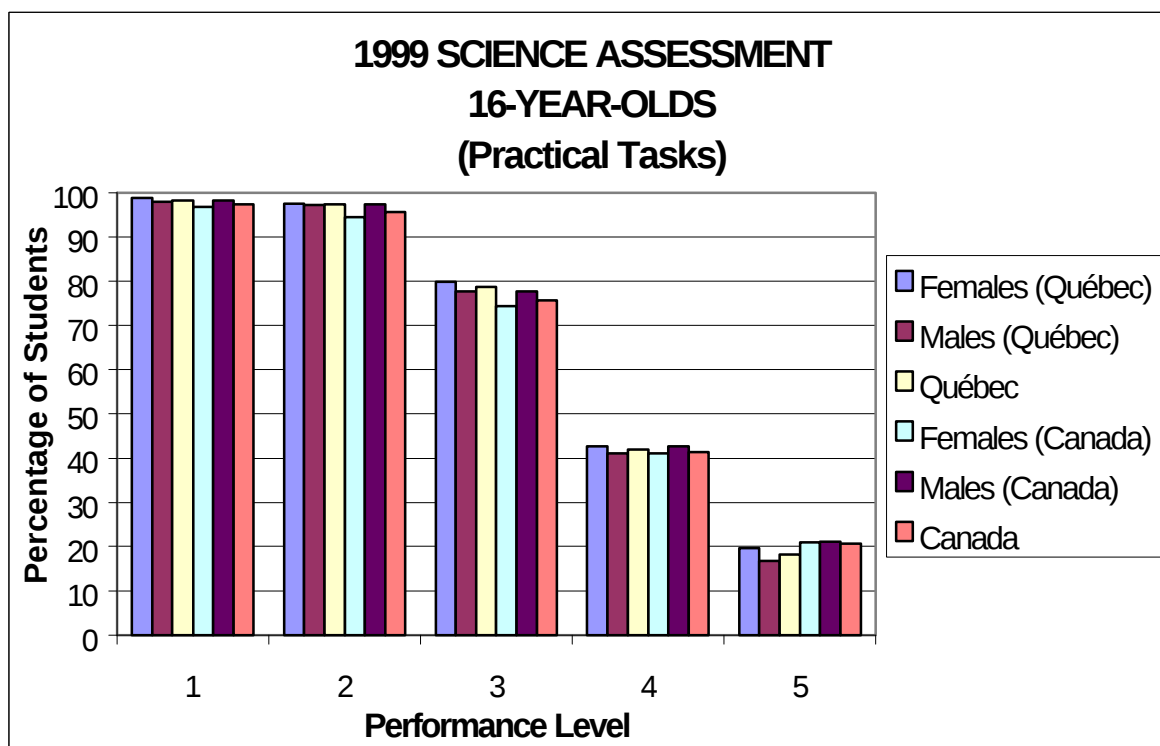
A description of the five levels of performance is provided in Appendix B.

Table 4 shows the percentages of 16-year-old students in Québec attaining each level of performance in science inquiry skills. The results are provided by gender.

- **Levels 1 and 2** are attained by nearly all male and female 16-year-olds.
- **Level 3** is attained by about 80 per cent of male and female 16-year-olds.
- **Level 4** is attained by more than 40 per cent of male and female 16-year-olds.
- **Level 5** is attained by nearly 20 per cent of male and female 16-year-olds.

Table 4
PERFORMANCE OF 16-YEAR-OLDS
— SCIENCE INQUIRY SKILLS —
(PRACTICAL TASKS)

Results of 16-Year-Olds by Gender					
	Performance Level (by %)				
Population	1	2	3	4	5
Females (Québec)	98.8 ± 1.1	97.5 ± 3.6	79.8 ± 4.5	42.7 ± 4.0	19.6 ± 3.7
Males (Québec)	97.9 ± 0.8	97.2 ± 3.9	77.7 ± 4.8	41.1 ± 4.3	16.7 ± 3.7
Québec	98.3 ± 0.9	97.3 ± 1.1	78.7 ± 2.8	41.9 ± 3.4	18.2 ± 2.6
Females (Canada)	96.8 ± 0.8	94.4 ± 1.0	74.3 ± 2.0	41.0 ± 2.2	21.0 ± 1.9
Males (Canada)	98.3 ± 0.6	97.3 ± 0.7	77.7 ± 1.9	42.7 ± 2.2	21.2 ± 1.8
Canada	97.4 ± 0.5	95.6 ± 0.7	75.7 ± 1.4	41.4 ± 1.6	20.7 ± 1.3



The confidence levels indicated in the table must be considered before it is concluded that the results are statistically different. In this case, there is no statistical difference for any performance level.

5. COMMENTS ON THE RESULTS

Results of 13- and 16-Year-Olds in the Written Assessment

As expected, a significant difference exists between the 13-year-olds and the 16-year-olds at all levels. There is a higher percentage of 16-year-olds in levels 3, 4 and 5. It should be noted here that the same assessments were administered to the 13-year-olds and the 16-year-olds.

Because the performance levels cover a vast sum of knowledge and skills in science and may be used to describe learning acquired during a number of years of schooling, it is normal that very few 13-year-olds meet the requirements defined for levels 4 and 5. Even though the results of the 1999 assessment are higher than those of the 1996 assessment, very few 13-year-olds attain levels 4 and 5.

Results in the Written Assessment, by Linguistic Group

When the overall achievement of francophones and anglophones is compared, there is no significant difference in the performance of the two linguistic groups in the 1999 written assessment. Even when the results of each linguistic group are examined for each performance level, a difference is observed only at level 3, in favour of the 13-year-old francophones.

The results of 13-year-old francophones and anglophones and 16-year-old francophones increased in the same proportion as the results for Canada as a whole in the 1999 assessment, compared with the 1996 assessment. The significant differences observed in the performance of 16-year-old anglophones and francophones in the 1996 assessment, in favour of the francophones, no longer exist in the 1999 assessment. We can therefore conclude that there are no significant differences between the results of francophone and anglophone 13- and 16-year-olds in the 1999 assessment.

Results in the Written Assessment, by Gender

For Québec, 13-year-old francophone females and males achieve similar results, whereas 16-year-old males perform slightly better than females of the same age at level 4 only, as is the

case for Canada as a whole. Among anglophones, male and female 13- and 16-year-olds obtain similar results at all levels.

Results of 16-Year-Olds in the Practical Task Assessment, by Gender

Because practical task assessment on a large scale is very demanding in terms of time, effort and cost, Québec and several other provinces did not select a specific sample of 13-year-olds and 16-year-olds for the 1996 assessment. However, for the 1999 assessment, a sample sufficiently large to obtain results representative of 16-year-old students was selected. For the 1999 practical task assessment, 16-year-old Québec males and females achieve results similar to those of Canada as a whole at all levels. There is no significant difference in the performance of 16-year-old Québec males and females.

6. CANADIAN RESULTS IN THE 1999 WRITTEN ASSESSMENT

A comparison of the Québec and Canadian results in the written assessment shows the following. As in the 1996 assessment, Alberta's 13- and 16-year-olds achieve higher results than Québec's students at all performance levels except the first and second, where Québec francophone students have similar results.

- 88 per cent of Canadian 13-year-olds and 94 per cent of Canadian 16-year-olds attain **level 1**. Québec students achieve similar results.
- 73 per cent of Canadian 13-year-olds and 87 per cent of Canadian 16-year-olds attain **level 2**. Québec students achieve similar results.
- 53 per cent of Canadian 13-year-olds and 76 per cent of Canadian 16-year-olds attain **level 3**. In Québec, 13- and 16-year-old francophones achieve higher results, but 13- and 16-year-old anglophones have similar results.
- 9 per cent of Canadian 13-year-olds attain **level 4**. Québec students obtain similar results. With respect to 16-year-olds, 32 per cent of Canadian students meet the criteria set for level 4. Québec students have similar results.
- 1 per cent of Canadian 13-year-olds attain **level 5**. Students in Québec and most of the provinces achieve similar results. Six percent of Canadian 16-year-olds place in level 5. Québec francophone and anglophone 16-year-olds show similar results to those of Canadian students.

Table 5

PERFORMANCE OF 13-YEAR-OLDS IN THE 1999 WRITTEN ASSESSMENT

Population	Performance Level (by %)				
	1	2	3	4	5
British Columbia	91.1 ± 2.0	76.1 ± 2.9	57.9 ± 3.4	10.4 ± 2.1	1.3 ± 0.8
Alberta	90.7 ± 1.8	82.5 ± 2.4	64.9 ± 3.0	14.7 ± 2.3	2.7 ± 1.0
Saskatchewan	90.8 ± 1.9	75.5 ± 2.9	52.1 ± 3.3	7.8 ± 1.8	1.2 ± 0.7
Manitoba (anglophones)	86.6 ± 2.3	72.8 ± 3.0	53.7 ± 3.4	8.5 ± 1.9	0.5 ± 0.5
Manitoba (francophones)	70.7 ± 3.5	61.2 ± 3.7	40.3 ± 3.7	2.6 ± 1.2	0.2 ± 0.4
Ontario (anglophones)	88.4 ± 2.2	72.1 ± 3.1	48.4 ± 3.5	7.3 ± 1.8	0.5 ± 0.5
Ontario (francophones)	74.7 ± 2.9	57.2 ± 3.3	35.4 ± 3.2	3.4 ± 1.2	0.0 ± 0.0
Québec (anglophones)	85.9 ± 2.3	69.6 ± 3.0	50.5 ± 3.3	8.1 ± 1.8	0.8 ± 0.6
Québec (francophones)	86.5 ± 2.1	72.8 ± 2.8	57.3 ± 3.1	7.6 ± 1.7	0.3 ± 0.3
New Brunswick (anglophones)	89.7 ± 2.1	69.4 ± 3.2	49.7 ± 3.5	5.5 ± 1.6	0.1 ± 0.2
New Brunswick (francophones)	77.5 ± 2.6	60.5 ± 3.1	38.5 ± 3.1	4.3 ± 1.3	0.4 ± 0.4
Nova Scotia (anglophones)	89.5 ± 2.2	69.5 ± 3.3	48.2 ± 3.6	7.2 ± 1.9	0.1 ± 0.3
Nova Scotia (francophones)	75.0 ± 3.1	61.8 ± 3.5	40.2 ± 3.5	3.9 ± 1.4	0.0 ± 0.0
Prince Edward Island	90.2 ± 2.0	74.3 ± 2.9	52.9 ± 3.3	7.3 ± 1.7	0.2 ± 0.3
Newfoundland	83.6 ± 2.1	68.0 ± 2.6	46.9 ± 2.8	5.2 ± 1.2	0.7 ± 0.5
Nunavut	29.0 ± 2.9	17.5 ± 2.5	12.1 ± 2.1	1.8 ± 0.9	0.9 ± 0.6
Northwest Territories	67.4 ± 2.2	52.2 ± 2.3	36.0 ± 2.2	3.6 ± 0.9	0.4 ± 0.3
Yukon	82.9 ± 2.2	71.3 ± 2.6	55.0 ± 2.9	9.8 ± 1.7	1.5 ± 0.7
Canada	88.1 ± 0.6	73.3 ± 0.8	53.3 ± 0.9	8.5 ± 0.5	0.8 ± 0.2

Table 6

PERFORMANCE OF 16-YEAR-OLDS IN THE 1999 WRITTEN ASSESSMENT

Population	Performance Level (by %)				
	1	2	3	4	5
British Columbia	93.2 ± 1.9	87.6 ± 2.5	75.8 ± 3.2	29.5 ± 3.4	3.9 ± 1.4
Alberta	96.9 ± 1.1	93.3 ± 1.6	85.8 ± 2.3	49.8 ± 3.2	11.8 ± 2.1
Saskatchewan	94.3 ± 1.6	87.8 ± 2.2	77.4 ± 2.9	28.8 ± 3.1	4.9 ± 1.5
Manitoba (anglophones)	95.2 ± 1.4	90.2 ± 1.9	79.8 ± 2.6	35.5 ± 3.1	6.4 ± 1.6
Manitoba (francophones)	92.5 ± 2.0	89.4 ± 2.4	76.2 ± 3.3	21.9 ± 3.2	2.6 ± 1.2
Ontario (anglophones)	92.5 ± 2.0	84.8 ± 2.8	72.2 ± 3.4	28.0 ± 3.5	4.9 ± 1.7
Ontario (francophones)	86.6 ± 2.8	76.0 ± 3.5	60.1 ± 4.0	18.1 ± 3.1	2.6 ± 1.3
Québec (anglophones)	92.7 ± 1.7	86.3 ± 2.2	76.7 ± 2.7	32.4 ± 3.0	7.0 ± 1.6
Québec (francophones)	95.6 ± 1.3	90.6 ± 1.8	80.5 ± 2.4	32.8 ± 2.9	5.7 ± 1.4
New Brunswick (anglophones)	90.9 ± 2.2	83.7 ± 2.8	72.6 ± 3.3	28.3 ± 3.4	3.5 ± 1.4
New Brunswick (francophones)	89.7 ± 2.0	80.6 ± 2.6	69.4 ± 3.1	19.4 ± 2.6	2.6 ± 1.1
Nova Scotia (anglophones)	92.8 ± 1.5	86.5 ± 1.9	74.6 ± 2.4	29.5 ± 2.6	3.8 ± 1.1
Nova Scotia (francophones)	89.3 ± 5.3	83.3 ± 6.4	73.8 ± 7.6	38.1 ± 8.4	2.4 ± 2.6
Prince Edward Island	95.9 ± 1.6	92.0 ± 2.1	81.3 ± 3.1	35.9 ± 3.8	6.7 ± 2.0
Newfoundland	89.4 ± 1.9	82.0 ± 2.4	72.7 ± 2.8	30.4 ± 2.9	5.6 ± 1.4
Nunavut	51.6 ± 7.2	33.3 ± 6.8	23.8 ± 6.2	7.1 ± 3.7	1.6 ± 1.8
Northwest Territories	88.5 ± 2.5	79.9 ± 3.1	67.8 ± 3.7	29.4 ± 3.6	4.0 ± 1.5
Yukon	90.9 ± 2.2	86.2 ± 2.7	74.0 ± 3.4	38.2 ± 3.8	7.5 ± 2.1
Canada	93.6 ± 0.4	87.3 ± 0.6	76.1 ± 0.8	31.6 ± 0.8	5.6 ± 0.4

7. RESULTS OF 16-YEAR-OLDS IN CERTAIN PROVINCES IN THE 1999 PRACTICAL TASK ASSESSMENT

Because practical task assessment on a large scale is very demanding in terms of time, effort and cost, the SAIP had selected samples that would yield valid results for Canada as a whole but would not provide reliable information for individual provinces. Québec, and most of the provinces, decided not to oversample for the 1996 assessment in order to increase the validity of the student samples. However, for the 1999 assessment, Québec decided to select a representative sample of francophone and anglophone 16-year-old students.

The results of Québec francophone and anglophone 16-year-olds were equal or superior to those of students in other provinces that decided to select representative samples of their population and are comparable to those for Canada overall at all performance levels.

Table 7

PERFORMANCE OF 16-YEAR-OLDS — SCIENTIFIC INQUIRY SKILLS — (PRACTICAL TASKS)

Results of 16-Year-Olds					
	Performance Level (by %)				
Population	1	2	3	4	5
Saskatchewan	98.4 ± 0.9	96.0 ± 1.4	74.6 ± 3.1	35.1 ± 3.4	17.7 ± 2.7
Ontario (anglophones)	96.9 ± 1.4	94.3 ± 1.9	72.2 ± 3.6	39.4 ± 4.0	20.6 ± 3.3
Ontario (francophones)	97.0 ± 1.6	97.3 ± 1.1	64.7 ± 4.5	29.4 ± 4.3	13.9 ± 3.3
Québec	98.3 ± 1.6	97.3 ± 1.1	78.7 ± 2.8	41.9 ± 3.4	18.2 ± 2.6
Other provinces	97.2 ± 1.0	96.0 ± 1.1	78.1 ± 2.4	44.5 ± 2.9	23.3 ± 2.4
Canada	97.4 ± 0.5	95.6 ± 0.7	75.7 ± 1.4	41.4 ± 1.6	20.7 ± 1.3

8. THE PAN-CANADIAN AND OTHER STUDIES

This is the second pan-Canadian assessment of 13-year-olds and 16-year-olds that the Ministère de l'Éducation du Québec has taken part in. The results of this study confirm what was observed during the first.

With respect to the 13-year-olds, Québec has participated in other studies along with other Canadian provinces. In 1995, Québec students in Secondary I and II participated in the Third International Mathematics and Science Study (TIMSS). This study involved 40 countries and 6 Canadian provinces. The study was carried out under the direction of the International Association for the Evaluation of Educational Achievement (IEA). Québec also took part in a replication of this study (TIMSS-R) in 1999.

In this SAIP science assessment, the results of 13-year-old Québec students are lower than those of Alberta, but comparable to, and in some cases superior to, those of other Canadian provinces. In the 1995 TIMSS, as for the 13-year-olds in this study, the science results of Québec students are lower than those of Alberta's 13-year-olds. An analysis by domain of the TIMSS questions reveals that Alberta's 13-year-olds perform better than Québec's 13-year-olds on questions on "life science" and "environmental issues and the nature of science." The TIMSS-R report is expected in December 2000 and will confirm whether this finding still applies.

APPENDIXES

APPENDIX A

DESCRIPTION OF PERFORMANCE LEVELS FOR SCIENCE CONCEPTS¹ (WRITTEN ASSESSMENT)

The following are examples of criteria that give a general impression of the difficulties experienced by students in the written assessment, but are by no means a complete list.

At **level one**, the student can:

- describe physical properties of objects
- distinguish living things from nonliving things and their respective environments
- recognize that energy can appear in different forms
- recognize that objects in the universe undergo change
- demonstrate care and accuracy during scientific investigations
- identify various technologies important to society

At **level two**, the student can:

- classify substances according to their physical properties
- compare various plant and animal adaptations
- know that the amount of energy in the universe is conserved but that it can change form and be transferred
- know that the movement and tilt of the Earth affects cycles such as years, days and seasons
- explain that there are different forms of scientific investigations and that their results may contradict each other
- identify technologies that influence science, and science knowledge that leads to new technologies

At **level three**, the student can:

- use chemical properties to compare and classify substances
- know that some life forms are unicellular and others are multicellular, and that life forms are involved in the transfer of energy
- compare gravitational and electrical forces
- compare changes in Earth's surface and their causes
- analyze experiments and judge their validity
- identify areas where science knowledge and technologies address societal problems

1. *Information Bulletin for Schools, 1999 Science Assessment, School Achievement Indicators Program*, Council of Ministers of Education, Canada, January 1999, pp. 4-7.

At **level four**, the student can:

- describe and compare particles in terms of protons, neutrons and electrons
- state the importance and role of DNA
- analyze uniform motion in one dimension
- use the theory of plate tectonics to explain various geological activities
- explain that scientific progress is the result of ongoing experimentation and evaluation
- describe a situation where science or technology has affected our view of what the world is like

At **level five**, the student can:

- relate properties of substances to their molecular structure
- know that various factors can mutate DNA and that some mutations may be passed on to offspring
- analyze uniform motion in two dimensions
- evaluate evidence for the theory of plate tectonics
- explain conditions used to evaluate scientific theories
- show the influence of world views on science and technology

APPENDIX B

DESCRIPTION OF PERFORMANCE LEVELS FOR SCIENCE INQUIRY SKILLS (PRACTICAL TASKS)

The following are examples of criteria that may be used to gain a general impression of the difficulties experienced by students in the practical tasks, but are by no means a complete list.

At **level one**, the student can:

- ask and identify relevant questions
- carry out identified procedures
- make relevant observations

At **level two**, the student can:

- infer or predict possible answers to questions
- identify appropriate procedures and important variables
- organize and record observations and measurements accurately

At **level three**, the student can:

- identify sources of error
- identify patterns, trends and simple relationships
- extrapolate or interpolate

At **level four**, the student can:

- formulate hypotheses and/or predictions to guide research
- organize and present data in concise and effective forms such as data charts, graphs, and mathematical and statistical treatments
- develop explanations by relating data to known information
- suggest alternatives or improvements to an experimental design

At **level five**, the student can:

- design appropriate experiments
- evaluate the reliability and accuracy of data and explain its limitations
- evaluate the effects of sources of error
- identify factors that influence the acceptance or rejection of a body of evidence or a theory

APPENDIX C

PERFORMANCE OF 13- AND 16-YEAR-OLDS IN THE 1996 WRITTEN ASSESSMENT

Population	Performance Level (by %)				
	1	2	3	4	5
13-Year-Olds					
British Columbia	89.1 ± 1.9	74.9 ± 2.6	45.5 ± 3.0	3.0 ± 1.0	0.6 ± 0.5
Alberta	91.5 ± 1.6	83.0 ± 2.2	55.7 ± 2.9	11.3 ± 1.9	1.2 ± 0.7
Saskatchewan	92.4 ± 1.7	76.1 ± 2.7	44.9 ± 3.1	4.3 ± 1.3	0.0 ± 0.0
Manitoba (francophones)	76.7 ± 2.9	59.8 ± 3.4	29.4 ± 3.2	2.8 ± 1.1	0.1 ± 0.1
Manitoba (anglophones)	90.9 ± 1.8	72.9 ± 2.8	42.4 ± 3.1	5.9 ± 1.5	0.7 ± 0.5
Ontario (francophones)	78.3 ± 2.6	57.1 ± 3.1	26.9 ± 2.8	2.2 ± 0.9	0.0 ± 0.0
Ontario (anglophones)	86.3 ± 2.0	67.4 ± 2.8	36.6 ± 2.8	5.5 ± 1.4	0.2 ± 0.3
Québec (francophones)	91.1 ± 1.7	73.3 ± 2.6	48.4 ± 3.0	5.2 ± 1.3	0.0 ± 0.0
Québec (anglophones)	90.5 ± 1.8	72.6 ± 2.8	43.0 ± 3.1	5.0 ± 1.4	0.2 ± 0.3
New Brunswick (francophones)	81.7 ± 2.3	60.4 ± 2.9	34.8 ± 2.8	2.5 ± 0.9	0.0 ± 0.0
New Brunswick (anglophones)	91.0 ± 1.8	70.6 ± 2.9	43.7 ± 3.2	3.2 ± 1.1	0.0 ± 0.0
Nova Scotia (francophones)	82.4 ± 5.0	73.7 ± 5.8	38.5 ± 6.4	0.0 ± 0.0	0.0 ± 0.0
Nova Scotia (anglophones)	91.3 ± 1.9	73.3 ± 2.9	39.3 ± 3.3	4.6 ± 1.4	0.2 ± 0.3
Prince Edward Island	92.0 ± 1.7	76.4 ± 2.7	45.8 ± 3.1	3.4 ± 1.1	0.0 ± 0.0
Newfoundland	88.9 ± 2.1	71.4 ± 3.0	38.2 ± 3.2	4.5 ± 1.4	0.0 ± 0.0
Northwest Territories	55.6 ± 5.0	40.6 ± 5.0	20.6 ± 4.1	1.4 ± 1.2	0.2 ± 0.5
Yukon	93.0 ± 2.2	76.2 ± 3.7	48.6 ± 4.4	8.0 ± 2.4	0.3 ± 0.4
Canada	88.8 ± 0.5	71.9 ± 0.8	43.0 ± 0.8	5.5 ± 0.4	0.3 ± 0.1
16-Year-Olds					
British Columbia	95.3 ± 1.4	87.6 ± 2.1	69.2 ± 2.9	23.6 ± 2.7	5.4 ± 1.4
Alberta	94.3 ± 1.4	90.8 ± 1.7	78.6 ± 2.4	42.1 ± 2.9	8.1 ± 1.6
Saskatchewan	97.0 ± 1.1	89.9 ± 2.0	71.0 ± 3.1	26.7 ± 3.0	4.6 ± 1.4
Manitoba (francophones)	93.4 ± 2.4	86.0 ± 3.3	67.8 ± 4.4	30.2 ± 4.3	1.1 ± 1.0
Manitoba (anglophones)	96.1 ± 1.3	88.8 ± 2.1	67.8 ± 3.0	29.6 ± 3.0	4.0 ± 1.3
Ontario (francophones)	90.1 ± 2.0	78.0 ± 2.7	51.4 ± 3.3	14.9 ± 2.3	0.8 ± 0.6
Ontario (anglophones)	93.8 ± 1.5	85.2 ± 2.2	64.9 ± 3.0	22.6 ± 2.6	2.5 ± 1.0
Québec (francophones)	96.2 ± 1.1	90.3 ± 1.7	73.4 ± 2.6	28.6 ± 2.6	1.7 ± 0.7
Québec (anglophones)	95.4 ± 1.3	85.2 ± 2.2	65.6 ± 3.0	21.2 ± 2.6	3.5 ± 1.2
New Brunswick (francophones)	92.4 ± 1.6	79.7 ± 2.5	58.0 ± 3.1	13.9 ± 2.1	1.1 ± 0.6
New Brunswick (anglophones)	96.5 ± 1.2	87.2 ± 2.2	69.8 ± 3.1	19.9 ± 2.7	3.2 ± 1.2
Nova Scotia (francophones)	97.5 ± 3.6	93.6 ± 5.6	80.3 ± 9.2	33.8 ± 10.9	1.3 ± 2.6
Nova Scotia (anglophones)	98.6 ± 0.9	91.2 ± 2.1	68.5 ± 3.4	19.4 ± 2.9	2.5 ± 1.1
Prince Edward Island	95.6 ± 1.5	88.8 ± 2.3	68.6 ± 3.3	22.5 ± 3.0	2.8 ± 1.2
Newfoundland	96.8 ± 1.2	88.0 ± 2.2	64.4 ± 3.2	25.0 ± 2.9	4.8 ± 1.4
Northwest Territories	78.2 ± 5.9	65.6 ± 6.8	44.4 ± 7.1	27.8 ± 6.4	3.9 ± 2.8
Yukon	94.4 ± 3.3	86.9 ± 4.8	73.9 ± 6.3	32.4 ± 6.7	5.9 ± 3.4
Canada	95.0 ± 0.4	87.6 ± 0.6	69.0 ± 0.8	26.1 ± 0.8	3.4 ± 0.3