THIRD INTERNATIONAL MATHEMATICS AND SCIENCE STUDY (REPEAT PROJECT) — TIMSS-99

QUÉBEC REPORT

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1. Background

The Third International Mathematics and Science Study [Repeat Project (TIMSS-99)] was, like the initial project, organized by the International Association for the Evaluation of Educational Achievement (IEA).

The project was designed to assess students' knowledge, compare the performance of participating countries and provinces, and provide information on curricula and teaching methods. In addition, the 1999 assessment gave the countries that took part in the 1995 assessment an opportunity to identify any changes that had occurred over the intervening four-year period.

Thirty-eight countries, including Canada, took part in the 1999 assessment. The Canadian sample included students and teachers from nine out of ten provinces. Five provinces, including Québec, elected to increase the size of their sample in order to obtain a sufficient number of respondents so that they could analyze their results independently. This report compares the scores of forty-three separate countries and provinces.

The assessment took place in May 1999. The Québec sample included 50 public and private schools, both English and French. Forty-seven schools and 1231 Secondary II students actually took part in the assessment. The students wrote a 90-minute test in mathematics and a separate test in science, and then answered a short questionnaire on their attitudes toward these two subjects. Teachers and school principals were asked to complete a questionnaire. As a last step, specialists provided information about mathematics and science curricula.

This report presents the results achieved by the Québec students, compares them to the results achieved by other participants in the international assessment, especially other Canadian students, and highlights the changes observed since the 1995 assessment in which Québec also took part. The data are taken from the Canadian report, available at the Direction de la sanction des études from the coordinator of the School Achievement Indicators Program**.** The information collected from teachers, school principals and specialists is not included in this report. The Canadian report presents a detailed analysis of student results and information on curricula and teaching methods.

2. Mathematics results

The TIMSS-99 mathematics questions focused on five main content areas: fractions and number sense; measurement; data representation, analysis and probability; geometry and algebra. The tests mainly involved multiple-choice questions, although some questions required the students to construct short or long responses.

Mathematics test scores

Québec is in the top group of the 43 participating countries and provinces, behind Singapore, Korea, Taiwan, Hong Kong and Japan. Table 1 gives a summary of the mathematics scores for all Canadian participants. Appendix 1 shows the scores for all participants in TIMSS-99, highlighting their position compared to Canada as a whole.

Table 1: Results achieved by Canadian students in mathematics (TIMSS-99)

	Mean	**Standard error**
International	48.7	0.07
Canada	53.1	0.25
Alberta	53.0 =	0.42
British Columbia	52.2 =	0.56
Ontario	51.7 =	0.30
QUÉBEC	**56.6 ↑**	**0.53**
Newfoundland	50.4	0.61

↑ Significantly above Canadian average = Essentially the same as Canadian average

Québec's result was significantly higher than that of all other Canadian participants. Alberta, British Columbia and Ontario form a second group of provinces whose results are essentially the same as the Canadian average. The score for Newfoundland was significantly below that of the other provinces.

Results in mathematics, by province and by sex

The results show no significant difference between boys and girls, confirming the trend toward a reduced mathematical achievement gap that has become increasingly marked over the last twenty years, at least for the age group assessed here.

Table 2 : Performance of Canadian students in mathematics, by province and by sex

	All		**Girls**		**Boys**	
	Mean	Standard error	Mean	Standard error	Mean	Standard error
Canada	531	2.5	529	2.5	533	3.2
Alberta	531	6.3	528	6.5	535	6.5
British Columbia	522	7.3	524	7.0	519	8.4
Ontario	516	3.2	514	3.6	519	3.6
Québec	**564**	**5.3**	**564**	**5.8**	**564**	**5.8**
Newfoundland	502	7.8	502	8.3	501	8.7

Evolution of results in mathematics, 1995 to 1999

Among the twenty-six countries that took part in both TIMSS-95 and TIMSS-99, Canada and two other countries showed a statistically significant improvement in mathematics over the four-year period, although the improvement was not large in absolute terms. The Canadian average progressed slightly from 52 to 53, an improvement of just over one percentage point. The performance of the Québec students did not improve significantly from a statistical point of view; only the students from Ontario improved their performance.

Results in mathematics, by content area

As mentioned above, the TIMSS-99 mathematics test covered five content areas: fractions and number sense; measurement; data representation, analysis and probability; geometry and algebra. Table 3 gives the results achieved by Canadian students in each area; the table contains important information for teachers and curriculum designers.

Table 3: Performance of Canadian students in each mathematics content area

	Fractions and number sense	Measurement	Data representation, analysis and probability	Geometry	Algebra
International	49.0 (0.10)	49.0 (0.10)	49.0 (0.10)	49.0 (0.10)	49.0 (0.10)
Canada	53.3 (0.25) ↑	52.1 (0.24) ↑	52.1 (0.45) ↑	50.7 (0.47) ↑	52.5 (0.24) ↑
Alberta	53.4 (0.34) ↑	52.3 (0.32) ↑	52.6 (0.33) ↑	49.3 (0.27) =	52.6 (0.33) ↑
British Columbia	52.9 (0.53) ↑	51.6 (0.47) ↑	51.4 (0.51) ↑	49.2 (0.43) =	51.7 (0.46) ↑
Ontario	52.2 (0.25) ↑	51.0 (0.25) ↑	51.1 (0.24) =	49.6 (0.22) =	51.5 (0.24) ↑
Québec	**56.2 (0.37) ↑**	**55.2 (0.37) ↑**	**55.2 (0.40) ↑**	**54.4 (0.35) ↑**	**55.1 (0.37) ↑**
Newfoundland	51.0 (1.52) =	49.7 (0.49) =	50.4 (0.54) =	49.6 (0.47) =	50.6 (0.56) =

↑ Significantly above international average = Essentially the same as international average

The average mark for Québec students in each content area is significantly higher than the average mark for students in other provinces and in Canada as a whole. The Canadian average is significantly higher than the international average in each content area, and in no case does the average for a Canadian province fall below the international average.

Roughly one-third of the questions in the TIMSS-99 test were taken from the TIMSS-95 test, after being kept confidential for eventual re-use. The scores obtained for these questions show that the results achieved by Canadian students improved significantly between the assessments, in all content areas in the mathematics test except measurement.

Student attitudes toward mathematics

The questionnaire completed by the students as part of TIMSS-99 included five questions concerning their attitude toward mathematics. Students were to react to each of the five statements by giving one of the following four responses: “strongly agree,” “agree,” “disagree” or “strongly disagree.”

The results are shown in Table 4. The number in each cell of the table is the percentage of students who either agreed or strongly agreed with the statement.

Table 4: Students' Attitudes toward Mathematics (percent agree or strongly agree)

	Canada	Inter'l	Alb.	B.C.	Ont.	**QC**	Nfld.
I enjoy learning mathematics.	63	66	67	64	75	**47**	72
Mathematics is boring. (reverse scale)	42	37	47	52	37	**38**	42
Mathematics is an easy subject.	47	40	47	45	48	**45**	53
Mathematics is important to everyone's life.	94	91	92	92	96	**95**	96
I would like a job that involved using mathematics.	48	51	42	43	56	**44**	46

Almost all the students who took part in the assessment considered that mathematics was important to everyone's life. This was the only statement, out of five, that received this level of support from the students who took part in the assessment, whether in Canada or in other countries.

However, only 47% of Québec students, who did extremely well on the achievement test, indicated that they enjoyed learning mathematics. This level of agreement was substantially lower than was found in the rest of Canada, and also lower than the international mean by a wide margin. The same trend was observed in some Asian countries where the students also performed well on the achievement test.

3. Science results

The TIMSS-99 science questions focused on six main content areas: earth science; life science; physics; chemistry; environmental and resource issues; and scientific inquiry and the nature of science. The tests mainly involved multiple-choice questions, although some questions required the students to construct short or long responses.

Science test scores

The results achieved by Québec students in science were comparable to those achieved by students in British Columbia and in Canada overall. Alberta is in the top group of countries and provinces assessed. Table 5 gives a summary of the results for all Canadian participants. The results for all the participating countries and provinces are given in Appendix 2.

Table 5: Summary of results achieved by Canadian students in science (TIMSS-99)

	Mean	Standard error
International	48.8	0.07
Canada	53.3	0.21
Alberta	56.1 ↑	0.47
British Columbia	54.2 =	0.48
Ontario	51.8 =	0.31
Québec	**54.0 =**	**0.48**
Newfoundland	51.2	0.56

↑ Significantly above international average = Essentially the same as international average

The average score for Alberta is significantly higher than the Canadian average. Alberta is among the five best-scoring countries and provinces. The averages for Québec, British Columbia and Ontario are comparable to the average for Canada as a whole; the average for Newfoundland is significantly below the Canadian average.

Results in science, by province and by sex

The results show no significant differences between boys and girls in Québec and British Columbia. In Alberta, Ontario and Newfoundland and in Canada as a whole, boys outperformed girls. This is a reversal of the trend observed in 1995, when there was no significant difference between boys and girls in science.

Table 6: Performance of Canadian students in science, by province and by sex

	All		Girls		Boys	
	Mean	Standard error	Mean	Standard error	Mean	Standard error
Canada	533	2.1	526	3.2	540	2.4
Alberta	559	7.5	548	7.9	569	7.8
British Columbia	542	6.2	539	6.3	544	7.1
Ontario	517	3.3	509	3.7	526	3.9
Québec	**540**	**5.5**	**537**	**8.1**	**543**	**6.7**
Newfoundland	508	16.7	501	16.1	514	17.8

Evolution of results in science, 1995 to 1999

Canada's relative position among the group of countries that took part in both assessments has progressed considerably. On the TIMSS-95 scale, ten countries scored significantly better than Canada, whereas on the TIMSS-99 scale, only five countries scored better. Both Québec and Ontario showed a considerable improvement in science between the two assessments. The average score for Québec went up three points, and the average score for Ontario went up two points.

Results in science, by content area

As mentioned above, the questions in the TIMSS-99 science test covered six content areas: earth science; life science; physics; chemistry; environmental and resource issues; and scientific inquiry and the nature of science. Table 7 gives the results achieved by Canadian students in each area.

Table 7: Performance of Canadian students in each science content area

	Earth science	Life science	Physics	Chemistry	Environmental and resource issues	Scientific inquiry and the nature of science
International	49 (0.1)	49 (0.1)	49 (0.1)	49 (0.1)	49 (0.1)	49 (0.1)
Canada	52 (0.4) ↑	52 (0.4) ↑	52 (0.4) ↑	52 (0.5) ↑	52 (0.4) ↑	53 (0.5) ↑
Alberta	55 (0.4) ↑	55 (0.4) ↑	54 (0.4) ↑	54 (0.4) ↑	55 (0.3) ↑	55 (0.2) ↑
British Columbia	52 (0.4) ↑	53 (0.4) ↑	53 (0.4) ↑	53 (0.4) ↑	52 (0.4) ↑	54 (0.3) ↑
Ontario	50 (0.2) =	52 (0.3) ↑	51 (0.2) =	50 (0.2) =	51 (0.2) =	53 (0.2) ↑
Québec	**54 (0.4) ↑**	**51 (0.4) ↑**	**53 (0.4) ↑**	**54 (0.3) ↑**	**53 (0.4) ↑**	**53 (0.3) ↑**
Newfoundland	51 (1.4) =	51 (0.5) =	50 (0.4) =	50 (0.4) =	51 (0.5) =	53 (0.4) ↑

↑ Significantly above international average = Essentially the same as international average

The average scores for Alberta, Canada, British Columbia and Québec are significantly higher than the international average in each content area. In no case does the average score for a Canadian province fall significantly below the international average. Among the six content areas assessed, Québec recorded its lowest result in life science.

Roughly one-third of the questions in the TIMSS-99 test were taken from the TIMSS-95 test, after being kept confidential for eventual re-use. The scores obtained for these questions show that in all content areas, the results achieved by Canadian students improved significantly between the assessments.

Student attitudes to science

The questionnaire completed by the students as part of TIMSS-99 included five questions concerning their attitude toward science. Students were to react to each of the five statements by giving one of the following four responses: "strongly agree," "agree," "disagree" or "strongly disagree." The results are shown in Table 8. The number in each cell of the table is the percentage of students who either agreed or strongly agreed with the statement.

Table 8: Students' Attitudes toward Science (percent agree or strongly agree)							
	Canada	Inter'l	Alb.	B.C.	Ont.	**QC**	Nfld.
I enjoy learning science.	67	76	74	78	73	**55**	70
Science is boring. (reverse scale)	39	30	40	37	36	**40**	39
Science is an easy subject.	47	49	53	53	41	**48**	45
Science is important to everyone's life.	77	81	77	81	82	**67**	86
I would like a job that involved using science.	45	53	48	47	48	**37**	49

Canadian students achieved good results in the TIMSS-99 science test, but a substantial proportion do not like science as a subject. Students from Québec are those who like science the least. Compared to other Canadian participants, a smaller proportion of Québec students consider that science is important in life, or want to work in a scientific field.

In several countries, the science results are similar to those obtained for mathematics in that students expressed a low level of interest in the subject despite achieving good test results.

4. Conclusion

Québec students achieved excellent results in the Third International Mathematics and Science Study (Repeat Project). In mathematics, Québec is one of the countries or provinces with the highest scores, immediately behind Asian countries, which have the reputation of achieving high scores in this subject. In science, without being in the top group of participants, Québec obtained a mean score above the international average, and results that were comparable to those of British Columbia and Canada as a whole.

Between TIMSS-95 and TIMSS-99, the results achieved by Québec students in mathematics remained stable. In science, a significant improvement was noted.

Boys and girls have comparable results in both mathematics and science.

It is important to note that Québec students are less likely than other Canadian students to state that they like studying mathematics or science, despite their excellent results, especially in mathematics. They are also less likely to state that they would like to find a job in a scientific field.

APPENDIX 1

Summary of results in the TIMSS-99 mathematics test[1]

For each participating country or province, Tables 1 and 2 give the means scale score, the standard error of the mean and the average age of the students in that country or province at the time they wrote the test.

Table 1: Results of the Mathematics Test, TIMSS-99

Results Significantly Higher than Canada's				Results as Good as Canada's				Results Significantly Lower than Canada's			
Country	Mean	SE	Age	Country	Mean	SE	Age	Country	Mean	SE	Age
Singapore	60	(0.6)	14.4	Netherlands	54	(0.7)	14.2	Latvia (LLS)	51	(0.3)	14.5
Korea	59	(0.2)	14.4	Slovakia	53	(0.4)	14.3	**Newfoundland**	**50**	**(0.6)**	**14.0**
Taiwan	59	(0.4)	14.2	Hungary	53	(0.4)	14.4	United States	50	(0.4)	14.2
Hong Kong	58	(0.4)	14.2	**CANADA**	**53**	**(0.3)**	**14.0**	England	50	(0.4)	14.2
Japan	58	(0.2)	14.4	Slovenia	53	(0.3)	14.8	New Zealand	49	(0.5)	14.0
Québec	**57**	**(0.5)**	**14.3**	**Alberta**	**53**	**(0.4)**	**13.9**	Lithuania	48	(0.4)	15.2
Belgium (fl.)	56	(0.3)	14.1	Russia	53	(0.6)	14.1	Italy	48	(0.4)	14.0
				Australia	53	(0.5)	14.3	Cyprus	48	(0.2)	13.8
				British				Romania	47	(0.6)	14.8
				Columbia	**52**	**(0.6)**	**13.9**	Moldova	47	(0.4)	14.4
				Finland	52	(0.3)	13.8	Thailand	47	(0.5)	14.5
				Czech Repub.	52	(0.4)	14.4	Israel	47	(0.4)	14.1
				Malaysia	52	(0.4)	14.4	Tunisia	45	(0.2)	14.8
				Ontario	**52**	**(0.3)**	**13.9**	Macedonia	45	(0.4)	14.6
				Bulgaria	51	(0.6)	14.8	Turkey	43	(0.4)	14.2
								Jordan	43	(0.4)	14.0
								Iran	42	(0.3)	14.6
								Indonesia	40	(0.5)	14.6
								Chile	39	(0.4)	14.4
								Philippines	35	(0.6)	14.1
								Morocco	34	(0.3)	14.2
								South Africa	28	(0.7)	15.5

Note: The numbers shown is this display have been rounded and should not be used for determining significance levels.
SE: standard error. LLS: Latvian-language schools.

The average score for all countries is 49, compared to the average for Canada of 53. The average score of 57 obtained by students from Québec places them ahead of the students from the four other provinces that took part in the assessment.

[1] David F. Robitaille and Alan R. Taylor, *Third International Mathematics and Science Study, TIMSS-99, Canada Report, Volume 5: New Findings for a New Century* (Vancouver: International Association for the Evaluation of Educational Achievement [IEA]), December 2000, 4.

APPENDIX 2

Summary of results in the TIMSS-99 science test[2]

Table 2: Results of the Science Test, TIMSS-99

Results Significantly Higher than Canada's				Results as Good as Canada's				Results Significantly Lower than Canada's			
Country	Mean	SE	Age	Country	Mean	SE	Age	Country	Mean	SE	Age
Taiwan	57	(0.4)	14.2	Netherlands	55	(0.7)	14.2	United States	52	(0.5)	14.2
Singapore	57	(0.8)	14.4	**British**				**Newfoundland**	**51**	**(0.6)**	**14.0**
Alberta	**56**	**(0.5)**	**13.9**	**Columbia**	**54**	**(0.5)**	**13.9**	New Zealand	51	(0.5)	14.0
Hungary	55	(0.4)	14.4	Australia	54	(0.4)	14.3	Latvia	50	(0.5)	14.5
Japan	55	(0.2)	14.4	**Québec**	**54**	**(0.5)**	**14.3**	Italy	49	(0.4)	14.0
Korea	55	(0.3)	14.4	Czech Repub.	54	(0.4)	14.4	Malaysia	49	(0.4)	14.4
				England	54	(0.5)	14.2	Lithuania	49	(0.4)	15.2
				Finland	54	(0.4)	13.8	Thailand	48	(0.4)	14.5
				Slovakia	54	(0.3)	14.3	Romania	47	(0.6)	14.8
				Belgium (fl.)	54	(0.3)	14.1	Israel	47	(0.5)	14.1
				Slovenia	53	(0.3)	14.8	Cyprus	46	(0.2)	13.8
				CANADA	**53**	**(0.2)**	**14.0**	Moldova	46	(0.4)	14.4
				Hong Kong	53	(0.4)	14.2	Macedonia	46	(0.5)	14.6
				Russia	53	(0.6)	14.1	Jordan	45	(0.4)	14.0
				Ontario	**52**	**(1.3)**	**13.9**	Iran	45	(0.4)	14.6
				Bulgaria	52	(0.5)	14.8	Indonesia	44	(0.5)	14.6
								Turkey	43	(0.4)	14.2
								Tunisia	43	(0.3)	14.8
								Chile	42	(0.4)	14.4
								Philippines	35	(0.8)	14.1
								Morocco	32	(0.4)	14.2
								South Africa	24	(0.8)	15.5

Note: The numbers shown is this display have been rounded and should not be used for determining significance levels.
SE : standard error.

The average score for all countries is 49, compared to the average for Canada of 53. The average score of 56 obtained by students from Alberta places them ahead of the students from the other provinces that took part in the assessment. Québec students are not far behind the top-scoring group for science.

[2] David F. Robitaille and Alan R. Taylor, *Third International Mathematics and Science Study, TIMSS-99, Canada Report, Volume 5: New Findings for a New Century* (Vancouver: International Association for the Evaluation of Educational Achievement [IEA]), December 2000, 5.