Pan-Canadian results of francophone students in a minority-language setting in the School Achievement Indicators Program (SAIP)

ANALYTICAL REPORT

A REPORT PREPARED FOR THE
PAN-CANADIAN FRENCH AS A FIRST LANGUAGE PROJECT

OCTOBER 2004

Council of Ministers
of Education, Canada

Canada

TABLE OF CONTENTS

Note:
The full and complete research report entitled "Résultats pancanadiens des élèves francophones pédagogiques" (octobre 2002) submitted to the Council of Ministers of Education, Canada (CMEC) by the researchers, Rodrigue Landry and Réal Allard, is available, in French only, on the CMEC Web site.

1. FOREWORD

In 1993, the provinces and territories, under the auspices of the Council of Ministers of Education, Canada (CMEC), launched the School Achievement Indicators Program (SAIP) with a view to better assessing the effectiveness of the country's education systems and providing provincial and territorial jurisdictions and others working in education with a common reference and consistent information.

Two pan-Canadian SAIP assessment cycles were produced between 1993 and 1999, allowing data to be gathered on student performance in reading and writing, mathematics, and science. Students aged 13 and 16 from all provinces and territories participated in the assessments. Specialized questionnaires developed as part of SAIP were also administered to obtain contextual data on learning. Other contextual data have been gathered since 1999 from school principals and teaching staff. A third assessment cycle was launched in 2001 to add to the total of information, which will enable education partners to study and follow the evolution of their education system.

Results of SAIP assessments between 1994 and 1999 in reading and writing and in science, reveal that 13- and 16-year-old francophone students in minority settings had lower performance in these three areas than students in Canada overall, and lower than for francophones in Quebec; this was true for most provinces and territories.

Various studies have previously shown that these academic results are not due solely to pedagogical considerations, but to socio-cultural and economic issues as well. Whatever the case may be, student performance in minority situations is a concern, and requires special attention. It is crucial that these students be able to succeed over the years in acquiring a good knowledge of French as a language of instruction, so that they can continue their studies successfully from year to year. Developing cognitive and socio-cultural skills to enable them to use French as a tool for learning, communication, and self-affirmation is equally important. In short, it is important to target those interventions in the area of French-language education in minority settings to provide effective help to students.

In February 1995, the CMEC adopted the Pan-Canadian Protocol for Collaboration on School Curriculum. In the fall of 2000, ministers of education from across Canada, through the CMEC, established a cooperative project on teaching French as a first language. The Pan-Canadian French as a First Language Project (PCFFLP) supports the spirit and intent of collaboration as described in the aforementioned Protocol. In identifying this project as a priority for CMEC, ministers recognized that it was essential to take tangible, immediate steps to determine the underlying causes of lower performance by minority francophone students and find solutions to the problem.

Throughout the PCFFLP, expertise and human and financial resources in the area of French-first-language education were pooled. All provinces and territories, with the exception of Yukon and Quebec, participated in the project. Funding for PCFFLP was provided by participating jurisdictions, through the CMEC, and the Government of Canada, through the Department of Canadian Heritage.

The project was intended to improve the academic performance of minority francophone students. It consisted of two distinct segments, A and B, with the aim of analyzing SAIP data and producing useful resources for the short and longer term.

Description of Segment A

Segment A involved developing an in-depth analysis of minority francophone students' performance on SAIP mathematics, reading and writing, and science assessments, with a view to identifying reasons that might explain their lower performance, as well as to pinpointing avenues of action that might positively affect student performance.

Description of Segment B

Segment B involved the development of a francisation training kit for teachers from kindergarten to Grade 2 which was published in December 2003. The kit enables teachers to explore various facets of francisation and offers specific tools in support of the francisation process.

2. SEGMENT A: ANALYTICAL REPORT

As described above, the purpose of Segment A was to conduct an in-depth analysis of SAIP assessment results, to examine the factors affecting minority francophone student performance and decide on ways of enhancing their academic performance. This report presents the highlights of that research. Jurisdictions participating in the project worked jointly on a regular basis to analyze SAIP data from 1993 to 1999 in mathematics, reading and writing, and science, in collaboration with a team of university researchers.

Objectives of the report

- To list and review the research on factors relating to academic performance by students in minority francophone settings

- To conduct an in-depth analysis of student performance and contextual data gathered in surveys conducted in the first and second assessment cycles of SAIP

- To identify a range of possible avenues for intervention to improve students' academic performance

- To provide possible directions for further research on the subject

- To present possible avenues for follow-up to advance research and development in the field of minority francophone education.

2.1 REVIEW OF THE RESEARCH

SAIP assessments and a number of international studies have made it possible to compare the results of minority francophone students in Canada with those of other student groups. Also, databases, in particular Repère, ERIC, and CBCA Education, were searched and specialized periodicals were consulted to locate empirical studies on factors related to learning and academic performance of minority francophone students (see Abridged Bibliography, page 71).

2.1.1 Summary of results of minority francophone students on SAIP assessments and international surveys

SAIP assessments and three international surveys were analyzed for purposes of comparison: the Third International Mathematics and Science Study (TIMSS), the Programme for International Student Assessment (PISA), and the *Description internationale des enseignements et des performances en matière d'écrit* (DIEPE).

Overall results in international studies for minority francophone students in Canada were similar to those observed in SAIP studies. In mathematics, for instance, few significant differences were observed between the averages obtained by minority francophone students and those of majority anglophone students in the same jurisdictions. In reading and writing, and science, the summary of results obtained by minority francophone students reflects a lower performance than that of majority anglophone students and Canadian samples.

Factors relating to academic performance of minority francophone students

Although national and international studies report on the results of analyses assessing the extent of links between contextual variables and student performance, bibliographic research did not yield from the reports of these studies any analysis bearing specifically on links between contextual variables and the academic performance of minority francophone students. Nonetheless, the research did find empirical studies that sought to examine relationships between the characteristics of minority francophone students and academic performance.

Factors common to all school populations

Education research identifies and categorizes variables and assesses the extent of relationships between these variables and academic performance. The results of studies on factors relating to students' academic performance suggest that relationships between contextual variables and the performance of students in minority francophone settings are, generally speaking, similar to those for other student populations. In other words, the same factors influence the performance of different school populations.

These factors include:

- characteristics specific to individual students, such as gender, confidence in their abilities, interest in the subject being studied, and use of learning strategies;
- the school's organization and pedagogical resources, and the socio-economic level of the student's family.

Factors specific to a minority

The results of empirical research on factors in connection with learning and academic performance by minority francophone students establish important links among factors relating to various aspects of their sociolinguistic daily experience and academic performance.

These studies reveal, for example, that:

- the percentage of instruction received in French has a clearly positive influence on performance in French and no negative effect on performance in English;
- a community's ethnolinguistic and cultural vitality, as reflected in the proportion of the French-speaking population in a given region, has a positive effect on students' skills in French;
- the more the sociolinguistic daily experience is French-speaking and rich in interaction, the stronger students' skills are in French and the more strongly they express a desire to integrate into the francophone community.

The results of these studies confirm the importance of studying in greater depth the particular sociolinguistic contexts of French-speaking minorities in Canada, to find out in what way these contexts differ from those of students from other groups, and to determine whether these differences have any connection with academic performance.

2.2 LIMITATIONS AND CONSTRAINTS OF THE RESEARCH

In the context of this study, SAIP assessment data sets proved restrictive. An initial limitation of the study lay in the fact that the student questionnaires used to collect contextual data on learning were not designed uniformly, under a single plan. Questionnaires administered to the students did in fact present certain similarities, but also many points of divergence in terms of the number and kind of questions asked. Subsequently, the approach adopted in the study consisted of grouping those variables representing similar characteristics in a way that supported assessment of the strength and direction of relationships between different variables and academic performance.

A second limitation lay in the contextual variables available to create a language portrait of the students studied. The absence of factors such as the ethnolinguistic vitality of the communities and various aspects of students' sociolinguistic daily experience made it impossible to conduct any elaborate analysis of the language situation of students in minority settings in different parts of Canada. As previously mentioned, studies indicate that factors such as students' socialization and the vitality of the language community in which students live affect academic performance.

These components have effectively limited the educational consequences that might flow from the observed relationships in analyzing the data, and have restricted the identification and number of targeted interventions that could be introduced to meet the challenges identified.

3. Methodology used in the study

3.1   INTRODUCTION

The object of this study was to assess statistically the links that exist between contextual variables and academic performance of minority francophone students. Given the data available for purposes of the study, a methodology was adopted that would support grouping of contextual variables and make them independent of each other, to obtain a set of three mathematical analyses of the results that were statistically representative.

Problem to be solved

Placing contextual variables in relationship to performance variables in each of the studies comprising the two sets of SAIP assessments in mathematics, reading and writing, and science presented a number of sizeable challenges, including a high degree of diversity among the variables as well as the number of variables, which differed from one study to another.

On the one hand, the absence of a uniform theoretical framework made it impossible to verify a set of interrelationships among variables by means of a series of linear analyses. On the other hand, the application of statistical methods such as multiple regression introduced difficulties here: although this type of method made it possible to verify relationships among several independent variables (e.g., contextual variables identified in the course of this study) and a dependent variable (e.g., student performance on SAIP assessments), it was very difficult to discover the unique contribution of each variable, because the product of the mathematical equation is influenced by the interrelationship between independent variables.

In other words, the greater the number of variables included in the equation, the more complex the task of analyzing the unique contribution of one variable (e.g., students' confidence in their reading skills) with the dependent variable (e.g., students' performance in reading).

Solution chosen

The methodology adopted took these difficulties into consideration and focused on achieving the goals of statistical research, that is, identifying and quantifying the links existing between certain contextual variables and the academic performance of minority francophone students.

This methodology had two main advantages. The first was to reduce the total number of variables placed in relationship with performance, while including the contribution of all variables. The second was to render orthogonal, that is, independent of each other, those variables that help predict performance statistically, the objective being to be able to judge the unique contribution of a variable without that variable being influenced by others included in the mathematical multiple regression equation.

Using this methodology, three analyses were applied systematically to SAIP data. This series of analyses made it possible to examine differences in performance between minority francophone students and other student groups (see page 12 under *Grouping students* for a definition of these groups), study the behaviour of certain variables as they relate to performance of minority francophone students compared with other student groups, and lastly, examine the relationship between contextual variables and performance for all students as well as for minority francophone students.

3.2　FRAMEWORK OF THE STUDY

Initial data: SAIP assessments

The statistical analysis covered a set of 12 SAIP assessments conducted between 1993 and 1999, each of which included two components:

Mathematics	1993 and 1997
A. Mathematics Content	
B. Problem Solving	
Reading and Writing	1994 and 1998
A. Reading	
B. Writing	
Science	1996 and 1999
A. Written Assessment	
B. Practical Assessment	

Grouping students

For each of the three analyses, four groups of students were formed for purposes of the study:

COMPARATOR GROUPS USED IN THE STUDY	
French/Minority group	Students in French-language schools in minority language settings
French/Majority group	Students in French-language schools in Quebec
English/Minority group	Students in English-language schools in Quebec
English/Majority group	Students in English-language schools outside Quebec

For some analyses, results for the four student groups are shown by age (13 and 16); these subgroups are further divided to yield results separately for female and male students.

Mathematical tools

The application of a set of simple mathematical tools (e.g., calculation of averages, standard deviation, and relative performance levels based on data gathered in SAIP assessments) or more complex tools (e.g., calculation of explained variance using multiple regression technique) made this statistical study possible. These tools and techniques are briefly explained further in the description of the statistical analysis process. (See Appendix I, page 47.)

Scope of analysis

Note that the purpose of the study was to observe trends in the *French/Minority* group overall, not to analyze the special features of francophones in each province and territory. Certain trends observed in the results do not apply to individual jurisdictions. Also, not all jurisdictions make the distinction between students who attend French-language schools and those enrolled in French immersion. It should also be understood that Ontario students, for example, who represent approximately half the students in French-language schools outside Quebec, have greater weight in the observed results than other, less numerous groups. However, available codes in SAIP assessment data records made it impossible to factor in the demographic weight of francophones in the regions where individual students lived.

3.3 ANALYTICAL PROCESS

Three analytical phases were applied to each of the 12 SAIP assessments:

1. Descriptive analysis of performance.
2. Analysis of contextual variables.
3. Relationships between contextual variables and performance.

The order of the analyses was important because the descriptive results of the first two analyses (performance and contextual variables) made it possible to subsequently quantify the statistical degree of correlation between contextual variables and performance.

3.3.1 Phase 1: Descriptive analysis of performance

This analysis describes in detail the performance results for the four student groups categorized by age and gender. It allows observations about whether francophone students in a minority language situation perform differently from those in the other three groups, whether the differences are the same at age 13 and age 16, and differ between males and females. The results are compiled in tabular form and then interpreted through statistical measurements.

For each of the 12 SAIP assessments, a descriptive performance analysis is provided in order to prepare a summary table of average results and standard deviations for performance, as well as to calculate two statistical measures (relative rate of performance and difference in results expressed in standard deviation units) to evaluate the scope of differences in results between the *French/Minority* group and the Canadian sample. (See Appendix I, page 47.)

3.3.2 Phase 2: Descriptive analysis of contextual variables

In this phase, a descriptive analysis applies to the four student groups and two age groups for each of the contextual variables selected. This analysis also shows whether minority francophone students differ from other student groups on the contextual variables collated from questionnaires administered and whether those differences are the same for 13-year-old and 16-year-old students.

First, average results of student groups for each of the contextual variables selected are presented in table form. Second, a factorial analysis makes it possible to group together all those contextual variables that are highly correlated among themselves and a certain number of factors. Average performance results for each of these factors, expressed in units of standard deviation, are summarized in a second table. (See Appendix I, page 50.)

3.3.3   Phase 3: Relationships between contextual variables and performance

This final phase makes it possible to estimate the degree of relationship (or correlation) between contextual variables and performance variables in different areas of learning.

For each of the 12 SAIP assessments, a multitude regression analysis is applied first to the entire pan-Canadian sample and then to the *French/Minority* group. This two-step analysis identifies those variables most closely correlated with variations in student performance.

Also, combining the information gathered in Phases 2 and 3 of the analytical process made it possible to identify those variables with the greatest pedagogical consequences or requiring special pedagogical intervention. In other words, the contextual variables in which francophones in minority language settings were weak (based on the statistical results in Phase 2) and which had a high degree of correlation with performance (according to the statistical results in Phase 3) become important variables in planning pedagogical interventions. (See Appendix I, page 53.)

4. Summary of results of SAIP assessments

A summary of the principal results of SAIP assessments conducted between 1993 and 1999 is presented in this section, supporting a better connection between the results and pedagogical interventions that might contribute to improving the performance of minority francophone students. (See Appendix II, page 55.)

4.1 PHASE 1: PRINCIPAL PERFORMANCE DATA AND CONCLUSIONS

SAIP RESULTS COMPARED WITH CANADIAN AVERAGE
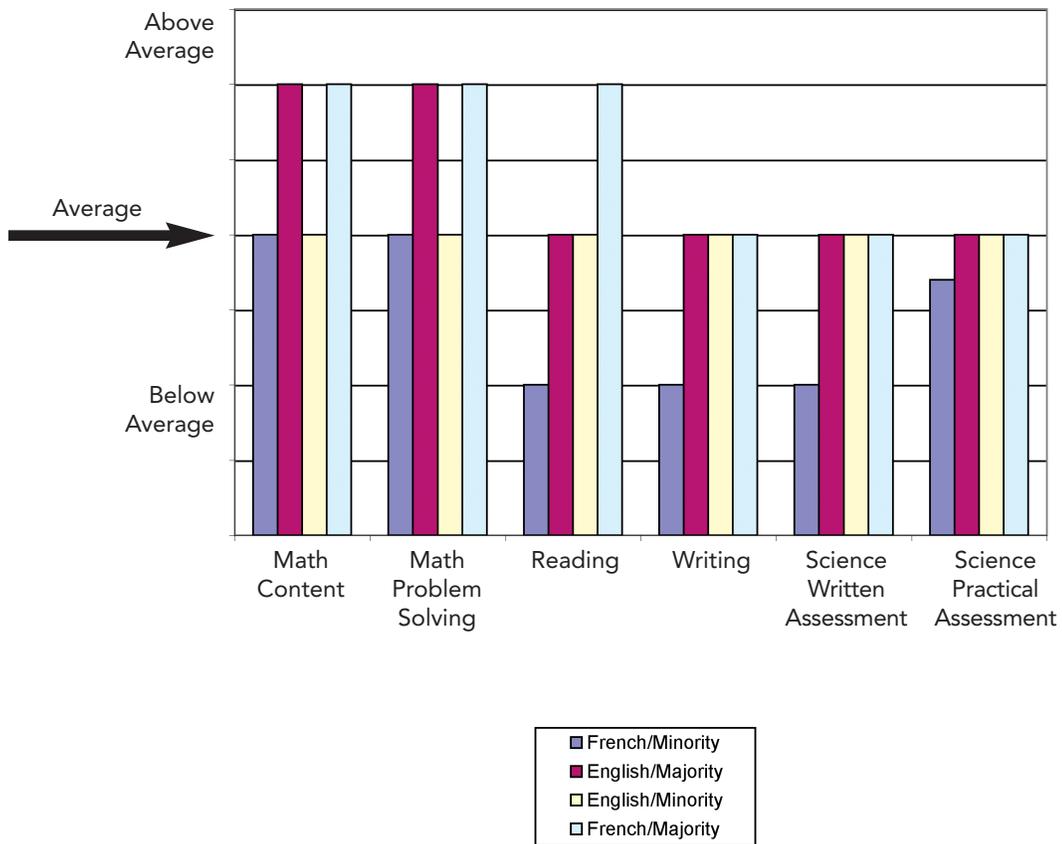
Legend:
- French/Minority
- English/Majority
- English/Minority
- French/Majority

SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS
IN MATHEMATICS
(CONTENT) (1993 AND 1997)

1993					LEVEL			
Group	Age	-1	1	2	3	4	5	Average
Canada	13	7%	32%	35%	25%	1%	0%	Level 1.8
FM	13	6%	32%	37%	24%	0.3%	0%	Level 1.8
Canada	16	3%	17%	21%	46%	9%	4%	Level 2.5
FM	16	2%	16%	23%	48%	7%	2%	Level 2.5
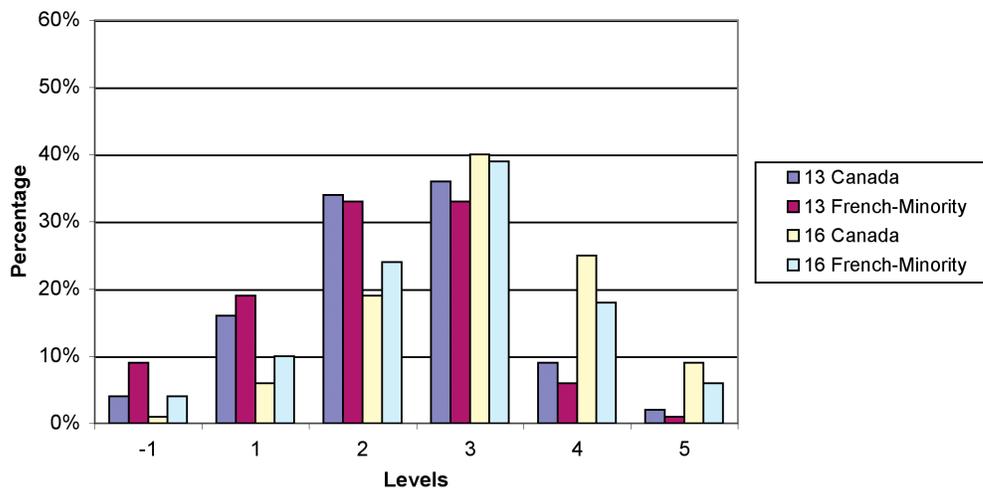
1997					LEVEL			
Group	Age	-1	1	2	3	4	5	Average
Canada	13	8%	31%	32%	28%	1%	0%	Level 1.8
FM	13	7%	34%	30%	27%	1%	0%	Level 1.8
Canada	16	4%	16%	19%	46%	11%	3%	Level 2.6
FM	16	4%	19%	21%	48%	8%	1%	Level 2.4
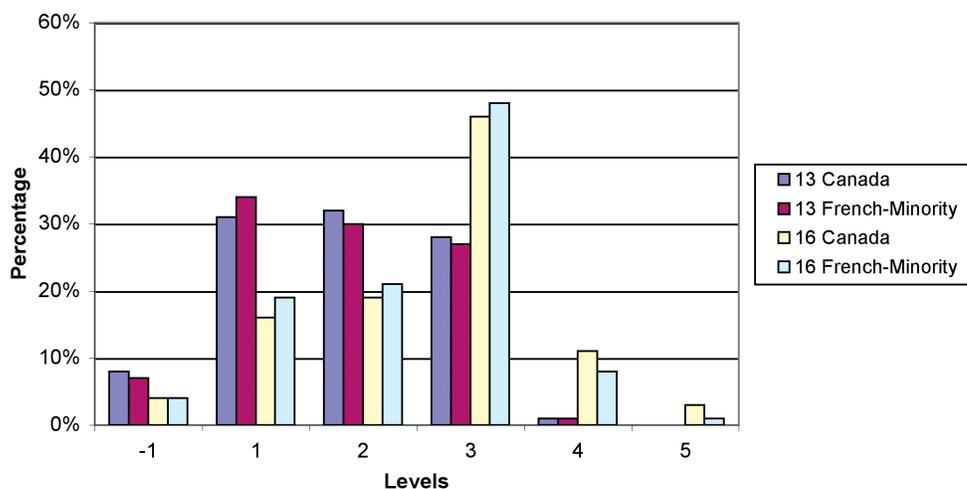
SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS IN MATHEMATICS (PROBLEM RESOLUTION) (1993 AND 1997)

1993 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	8%	35%	49%	8%	1%	0%	Level 1.6
FM	13	13%	43%	39%	4%	0%	0%	Level 1.4
Canada	16	4%	21%	51%	22%	3%	0%	Level 2
FM	16	6%	31%	46%	15%	2%	0%	Level 1.8
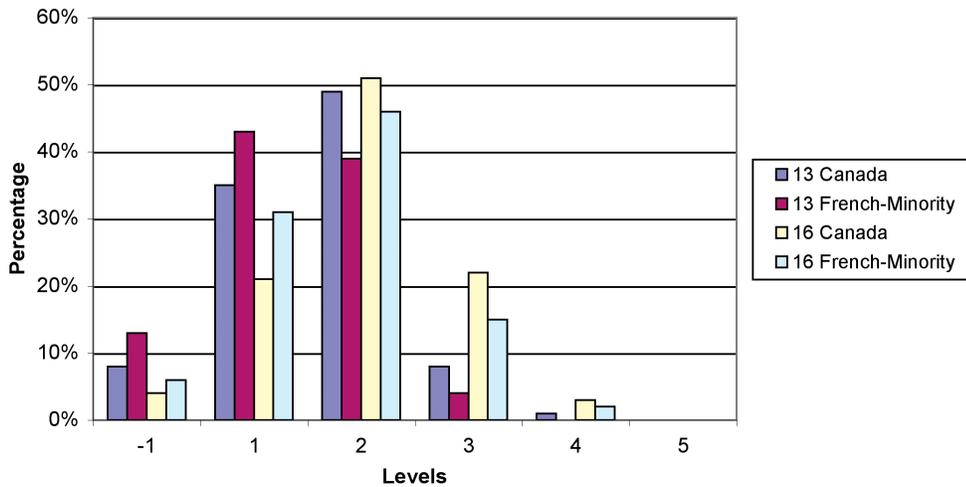
1997 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	19%	31%	36%	12%	2%	0%	Level 1.5
FM	13	20%	34%	33%	12%	1%	0%	Level 1.4
Canada	16	20%	14%	31%	23%	9%	2%	Level 2
FM	16	16%	18%	36%	23%	6%	1%	Level 1.9
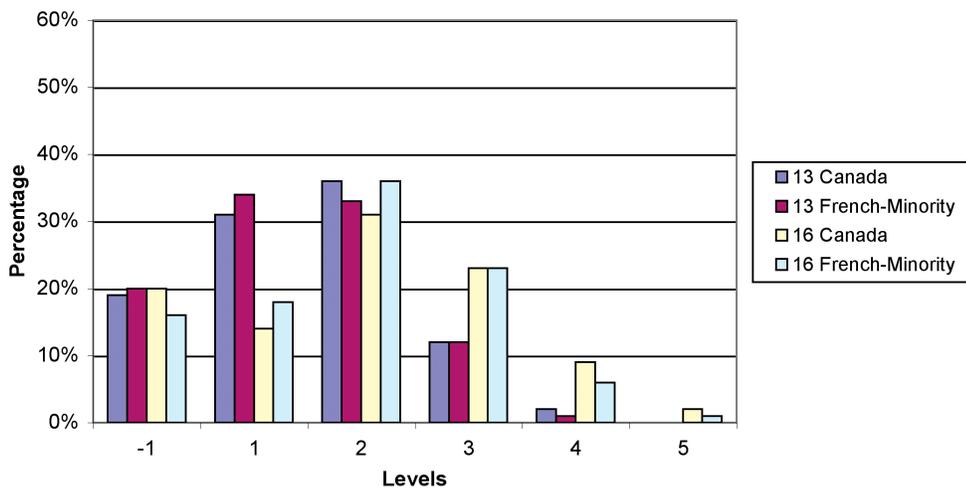
Mathematics (1993 and 1997): Analysis

- In 1993, average performance by students in the *French/Minority* group on Mathematics content was very similar to the average performance of the Canadian sample. The relative performance rate is thus equal to 1.00, that is, equivalent to the national average.

- The descriptive analysis of performance results also revealed that average performance by students in the *French/Minority* group was slightly higher even than the *English/Majority* group, and that the *French/Majority* group stood out in registering performance considerably higher than the Canadian average. Deviations from the Canadian average were explained more by the higher performance of both groups in Quebec (*French/Majority* and *English/Minority*) than by lower performance by francophones in minority settings.

- Performance by students in the *French/Minority* group in Problem Solving was not as high as in Mathematics content in 1993. Relative performance rates for females and males were low in both age groups.

- In 1997 variations in performance on Mathematics content between the *French/Minority* group and the entire Canadian sample were a little larger than in 1993.

- Performance by students in the *French/Minority* group in Problem Solving in 1997 was clearly higher than in 1993. Nonetheless, these performance figures were equivalent to those for the *English/Majority* group, based on the descriptive analysis of performance in the four student groups.

The analyses in Mathematics revealed no weakness that might be specific to the minority francophone group, given that the performance of students in this group was very similar to the Canadian sample and slightly higher than that of anglophones in majority communities. On the other hand, francophones in majority communities clearly performed higher than the average for the country as a whole. For this reason, the gap between performance by francophones in minority settings and performance of the Canadian sample was attributable more to the strong performance by francophones and anglophones in Quebec than to the lower performance of francophones in minority settings. Apparently, the observed differences cannot be attributed to the minority language status of francophones in minority settings.

The detailed statistical data appear in Appendix III, page 57.

SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS (READING) (1994 AND 1998)

1994 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	4%	16%	34%	36%	9%	2%	Level 2.4
FM	13	9%	19%	33%	33%	6%	1%	Level 2.1
Canada	16	1%	6%	19%	40%	25%	9%	Level 3.1
FM	16	4%	10%	24%	39%	18%	6%	Level 2.7
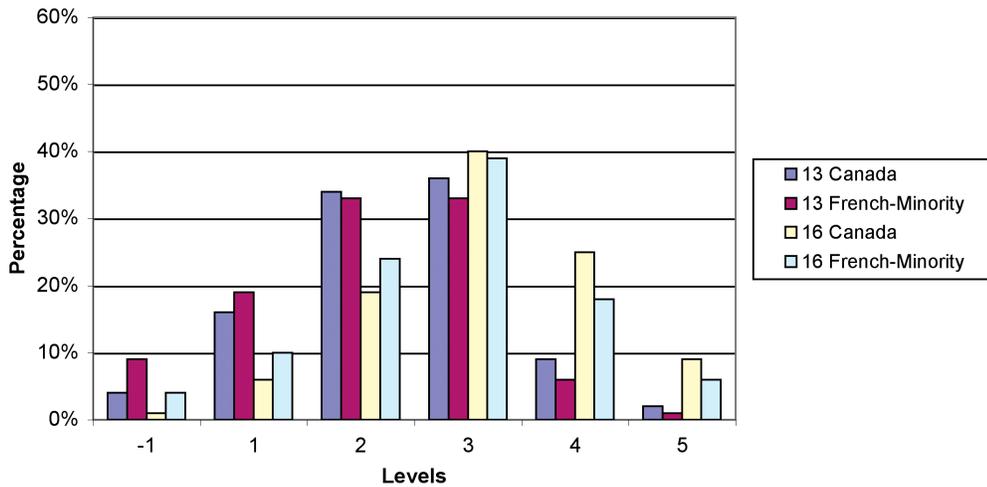
1998 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	3%	19%	37%	33%	8%	1%	Level 2.3
FM	13	4%	23%	37%	28%	8%	1%	Level 2.4
Canada	16	1%	7%	20%	38%	24%	10%	Level 3.1
FM	16	1%	10%	23%	37%	22%	8%	Level 2.9
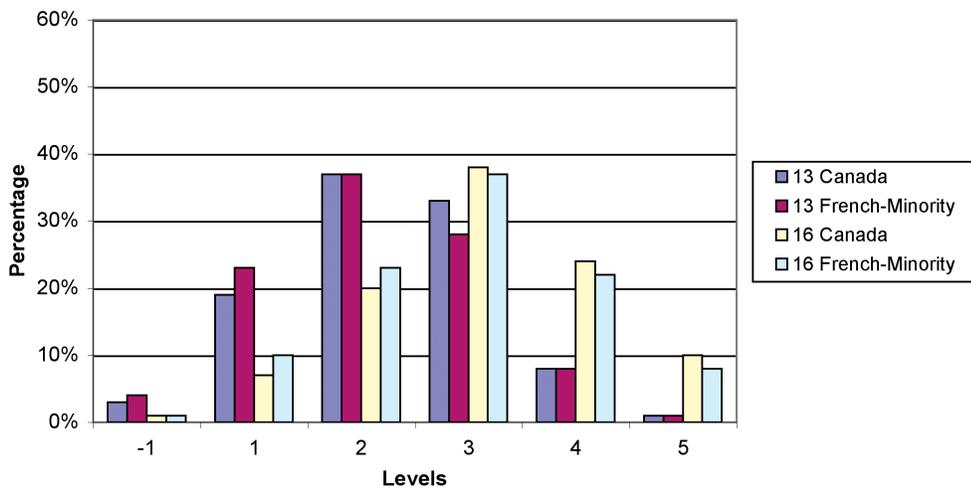
SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS (WRITING) (1994 AND 1998)

1994 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	0%	6%	30%	48%	13%	2%	Level 2.7
FM	13	2%	26%	46%	24%	2%	0%	Level 2
Canada	16	1%	12%	38%	40%	9%	1%	Level 2.5
FM	16	4%	10%	24%	39%	18%	6%	Level 2.7
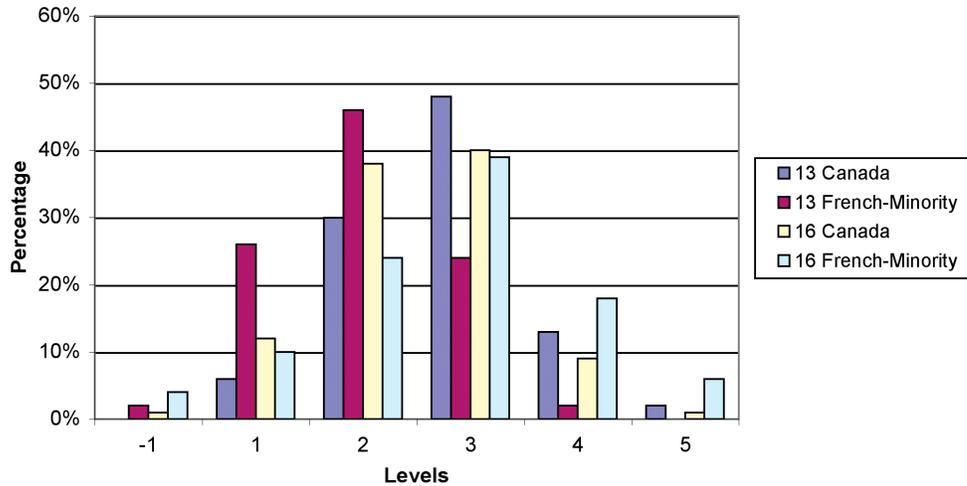
1998 Group	Age	LEVEL -1	1	2	3	4	5	Average
Canada	13	0%	4%	25%	52%	16%	2%	Level 2.9
FM	13	0%	17%	49%	30%	3%	0%	Level 2.2
Canada	16	0%	1.6%	13%	46%	30%	10%	Level 3.3
FM	16	0%	8%	37%	41%	13%	2%	Level 2.6
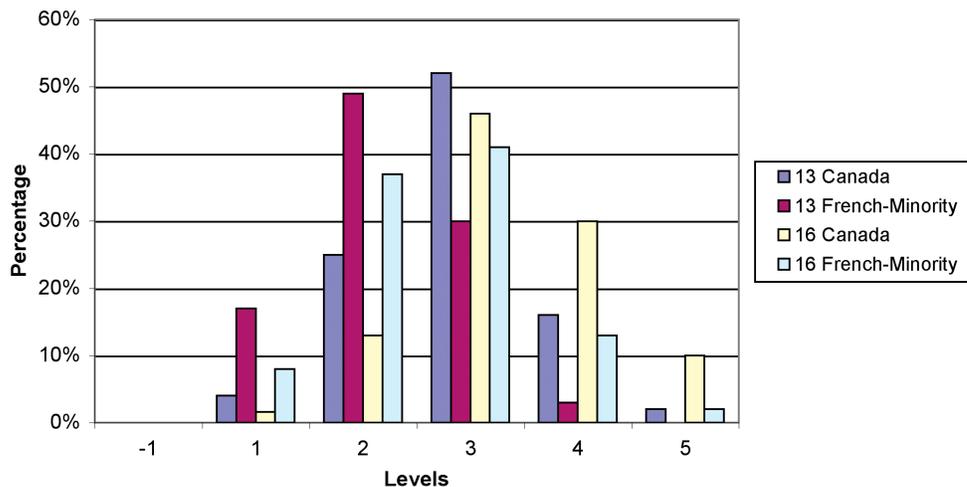
Reading and Writing (1994 and 1998): Analysis

- Writing was the greatest weakness of minority francophone students. However, difficulties varying from moderate to high were also observed in reading for that group, that is, *French/Minority*.

- Reading performance was higher for females than for males.

- Both in the *French/Minority* group and across Canada, girls had a clearly higher average performance in reading than males.

- In 1994, reading difficulties go from moderate (13-year-olds) to moderately high (16-year-olds) among females and high among males at either age.

- In 1998, males appeared to have improved their relative situation in terms of performance. It should be noted, however, that this improvement is explained in part by a drop in results for males across Canada.

- In the area of writing, performance differences in both 1994 and 1998 may be regarded as very high.

While the differences between the *French/Minority* group and the Canadian sample are less marked in reading than in writing, it should nonetheless be considered that reading performance in French is still lower when compared with the average performance of students in the *French/Majority* group.

The detailed statistical data appear in Appendix III, page 57.

SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS IN SCIENCE
(WRITTEN ASSIGNMENT) (1996 AND 1999)

1996		LEVEL						
Group	Age	-1	1	2	3	4	5	Average
Canada	13	11%	17%	29%	38%	5%	0%	Level 2.1
FM	13	21%	20%	29%	28%	2%	0%	Level 1.7
Canada	16	5%	7%	19%	43%	23%	3%	Level 2.8
FM	16	9%	12%	24%	40%	16%	1%	Level 2.5
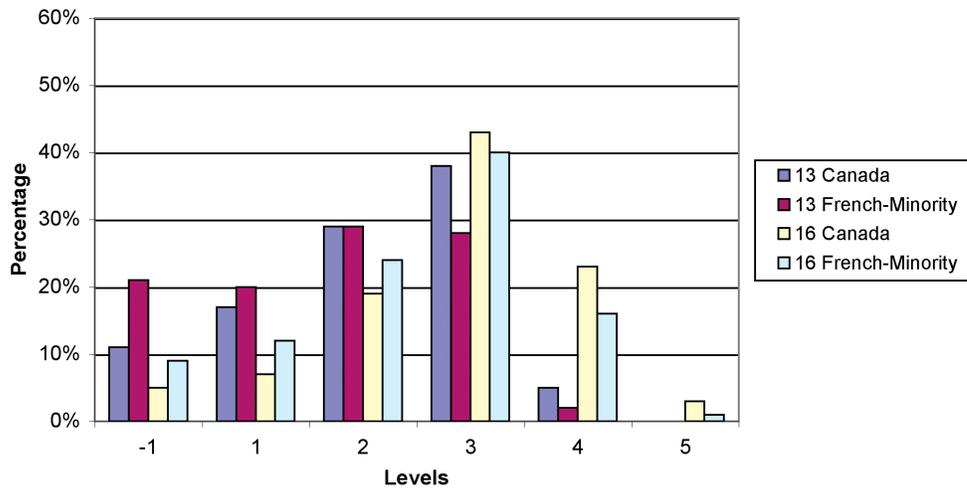
1999		LEVEL						
Group	Age	-1	1	2	3	4	5	Average
Canada	13	12%	15%	20%	45%	8%	1%	Level 2.3
FM	13	25%	16%	22%	33%	4%	0%	Level 1.7
Canada	16	6%	6%	11%	45%	26%	6%	Level 3
FM	16	12%	9%	14%	45%	17%	3%	Level 2.6
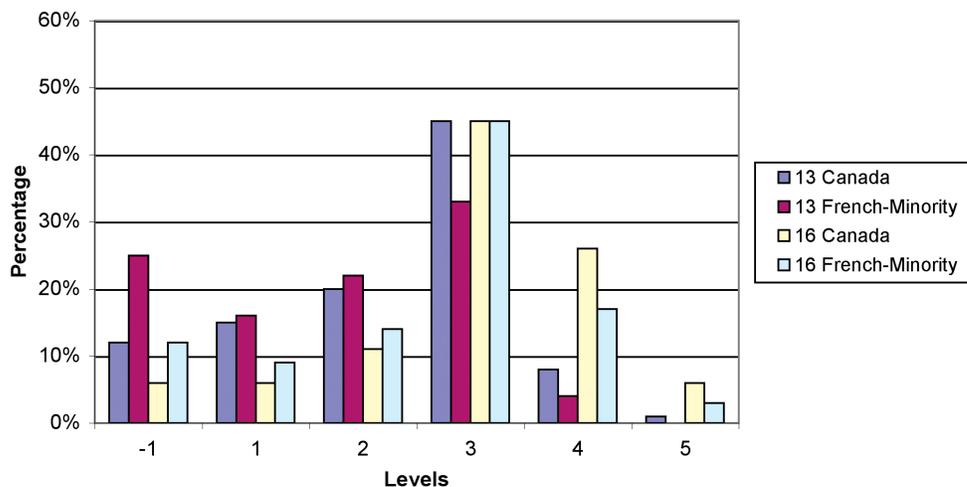
SAIP ASSESSMENT RESULTS FOR FRENCH-MINORITY STUDENTS IN SCIENCE
(PRACTICAL ASSIGNMENT) (1996 AND 1999)

1996		LEVEL						
Group	Age	-1	1	2	3	4	5	Average
Canada	13	4%	4%	51%	38%	3%	1%	Level 2.4
FM	13	6%	6%	55%	32%	1%	0%	Level 2.2
Canada	16	2%	1%	32%	46%	16%	4%	Level 2.8
FM	16	2%	3%	42%	45%	7%	1%	Level 2.6
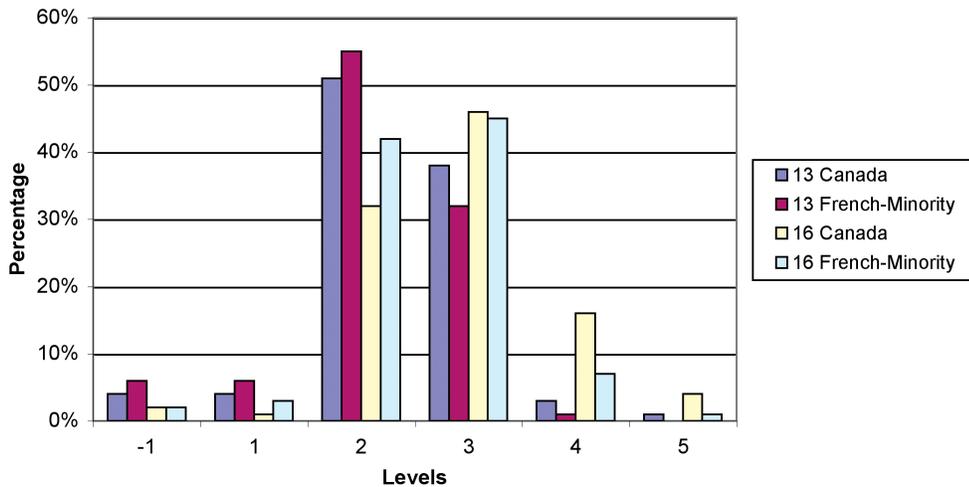
1999		LEVEL						
Group	Age	-1	1	2	3	4	5	Average
Canada	13	4%	6%	42%	35%	7%	6%	Level 2.5
FM	13	5%	8%	44%	31%	8%	4%	Level 2.4
Canada	16	2%	2%	20%	34%	20%	21%	Level 3.3
FM	16	3%	2%	28%	34%	17%	16%	Level 3.1
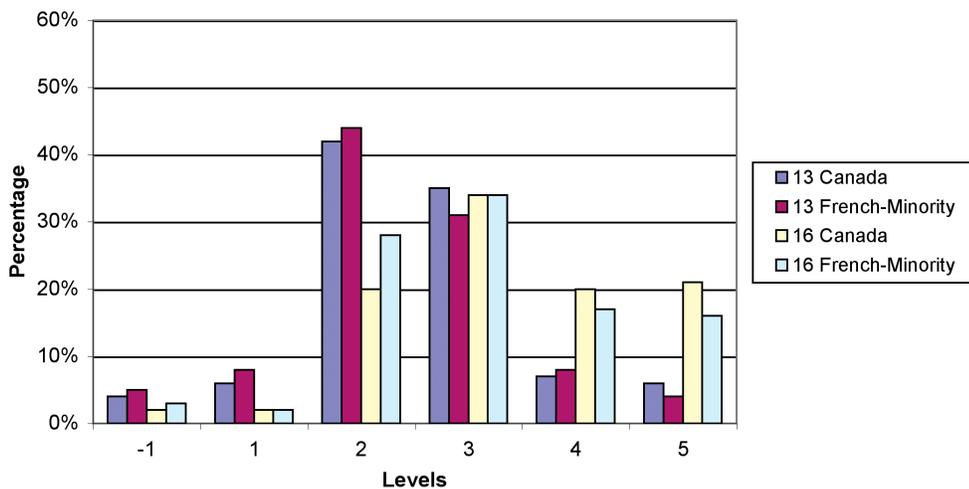
Science (1996 and 1999): Analysis

- Performance differences between males and females were very small.

- In the area of practical assessments in science, the relative overall performance of the *French/Minority* group was a little higher than its performance on the written assessment.

- In addition, females' performance in 1999 appears to be higher than in 1996.

The *French/Minority* group had the lowest average results of all four student groups, for both 13- and 16-year-olds and both females and males. Moreover, the difference compared with the national average is fairly large. The difference is less on the practical assessment.

The detailed statistical data appear in Appendix III, page 59.

4.1.4   Summary

The summary of student performance on SAIP assessments shows that in those academic subjects in particular that call for considerable use of the French language, that is, writing, reading, and science (written assessment), performance is notably lower among minority francophone students compared with their English-speaking counterparts in the same area or compared with the Canadian sample. The situation does not appear to be as serious in mathematics, where minority francophone students obtained results that were often equivalent and sometimes higher than those of anglophone students in the same respective areas and those of the Canadian sample.

SAIP results compared with Canadian average (1993-1999)

	Math Content	Math Problem Solving	Reading	Writing	Science Written Assessment	Science Practical Assessment
French Majority	Above Average	Above Average	Above Average	Average	Average	Average
French Minority	Average	Average	Below average	Below average	Below average	Very close to average
English Majority	Average	Average	Average	Average	Average	Average
English Minority	Above average	Above average	Average	Average	Average	Average

4.2 PHASES 2 AND 3: PRINCIPAL DATA ON CONTEXTUAL VARIABLES AND CONCLUSIONS

The detailed statistical data appear in Appendix III, page 57.

4.2.1 Mathematics

It should be noted that in mathematics, the *French/Minority* group does not display any significant weakness, given that performance of students in this group is similar in many respects to that of the Canadian sample and slightly higher than that of majority-setting anglophones. (See Appendix III, page 57.)

- Average performance results for the *French/Minority* group in mathematics tend to be very close to the Canadian average.

- Behaviour of the *Consultation* factor (consulting teachers, other students, or other individuals) is negatively related to performance in mathematics content and problem solving. This factor explains the greatest variance. This suggests that it may not be the behaviour of consulting that is at issue here, but rather the fact that students with low performance have the greatest tendency to ask for help. Students in the *French/Minority* group do not stand out from others on this factor, as their average results are very close to the Canadian average.

- The *Motivation* factor, which includes two variables, attitude toward mathematics and confidence in mathematics skills, is related positively to performance in mathematics, and is a favourable characteristic for high-level performance among the *French/Minority* group.

- Another motivational type factor, *Succeeding: effort and interest*, corresponds to the belief that students must work hard to pass mathematics. This factor is positively related to performance. Note that on this factor, the *French/Minority* group recorded results considerably higher than the Canadian average.

- A third factor related to motivation, *Succeeding: talent and luck*, had a very low negative relationship with performance in mathematics content. This belief is a little stronger among students in the *French/Minority* group than in the entire Canadian sample.

- Access to sophisticated calculators and computers is positively related to performance, especially for 16-year-olds.

- Time devoted to homework instead of television is positively related to performance. It thus appears that time devoted to homework is lower than average among the *French/Minority* group. Note, however, that these factors explain only a small proportion of the variance.

- Teamwork is positively related to performance in mathematics content. On this factor, the *French/Minority* group had an average result moderately higher than the Canadian average. Hence this is another characteristic favourable to this group.

- The *Learning strategies* factor brings together the following strategies: teacher explains the method, students take notes and work individually to solve problems. This pedagogical approach appears to have fairly neutral effects, given the weak relationship of this factor to performance.

- The factor related to time spent in provincial/territorial schools is positively related to performance. Students who have attended provincial/territorial schools in Canada for only a short time appear to have lower performance levels. The *French/Minority* group is not disadvantaged by this factor, since its average result exceeds the Canadian average.

The average francophone minority student differs very little from other students in the country. Minority language status does not appear to disadvantage those students. Less time devoted to homework is the only factor distinguishing francophone from anglophone students, both in Quebec and in minority settings.

Note: Summary tables 1, 2, and 3 following show only significant or highly significant relationships between context variables and the performance of the *French/Minority* group. Blanks denote weak or non-significant relationships. Factors followed by a minus (-) are negatively correlated with performance.

Summary Table 1
Context variable factors linked to mathematics performance:
type of factor, direction and strength of link, and scope of
difference between the *French/Minority* group and the Canadian average

Factors	13-year-olds	16-year-olds	Total
A. MATHEMATICS			
1. Content 1993			
Use of calculator		Significant	
Motivation	Highly significant	Significant	Significant
Homework vs. TV	Highly significant (-)	Highly significant (-)	Highly significant (-)
2. Problem-solving 1993			
Motivation	Significant		
Calculator and computer	Significant (-)	Significant	
TV vs. homework	Significant		
Time: prov./terr./schools			
3. Content 1997			
Consultation			
To succeed: effort and interest	Significant	Significant	Significant
Teamwork			
Learning strategies	Significant (-)		
To succeed: talent and luck			
4. Problem-solving 1997			
Consultation			
Motivation			
Learning strategies	Significant (-)		
To succeed: effort	Significant	Significant	Significant

Reading and writing

Readers will recall that the *French/Minority* group posted its lowest performance compared with all Canadian students in the area of reading and writing, with still more marked differences in writing.

Reading

- The use of cognitive strategies in reading, allowing students to better understand the text and teachers to verify students' interest in the text, is positively related to performance in reading. On this factor, the *French/Minority* group had average results clearly lower than the Canadian average.

- Another type of cognitive strategy in reading, resorting to avoidance strategies (e.g., avoiding unfamiliar words, giving up in the face of difficulties), is negatively related and has a moderately low relationship to performance. The *French/Minority* group resorts to this type of strategy more often than the Canadian average.

- A number of factors related to reading performance are of a motivational nature. Interest in a variety of kinds of reading is positively related to performance results: interest in current events, novels, and literary arts. Overall interest in reading has a positive, moderately high relationship with performance. On this factor, the *French/Minority* group recorded a result equivalent to the Canadian average.

- The *French/Minority* group had average results higher than the Canadian average in the area of interest in current events, interest in comics, sports and recreation, and interest in the literary arts. The group had an average result slightly lower than the Canadian average for interest in recreation and science. Interest in novels and reading in general was very similar to that of all Canadian students.

  - Certain types of interests are negatively linked to reading performance, such as interest in comics, sports, and leisure as well as leisure and science.

  - Relationships between performance and factor outcomes measuring varied interests do not necessarily mean that certain types of interest enhance reading performance while others decrease it. More likely, these links are related to the fact that the interests of students who were stronger in reading are different from those students who perform at a lower level.

  - However, it seems reasonable to assume that general interest in reading and reading frequency contribute over the long term to enhancing reading competency.

- On the *Love of reading* factor, another indicator of general interest in reading, the *French/Minority* group had an average result slightly lower than the Canadian average.

- The *Support from teacher* factor reflects students' belief that to succeed, they need a good teacher. On this factor, the *French/Minority* group had an average result slightly lower than the Canadian average. This factor is positively related to performance.

- Persistence in the face of difficulties is another motivational factor positively related to performance. The *French/Minority* group had an average result moderately lower than the Canadian performance on this factor.

- The *Reading time* factor, which refers to the amount of time devoted to reading, is positively related to performance. The *French/Minority* group did not stand out from other students on this factor. However, a moderately low average result can be observed among 16-year-old students in this group.

- The frequency of consulting on difficulties encountered in reading is negatively related to performance. However, there is no causal relationship between consulting and performance; rather, students weakest in reading tend to consult more often. The slightly higher than average result among the *French/Minority* group may be explained by the lower than average performance results for this group.

- On the *Favourable family setting* factor, the *French/Minority* group had an average result lower than the Canadian average in 1994 but equal to it in 1998. On the *Reading on the computer* factor, the *French/Minority* group had an average result higher than the Canadian average

Minority francophone students stood out in making less use of cognitive reading strategies, being less persistent in the face of reading difficulties, and making greater use of avoidance strategies.

Writing

- The characteristics most closely associated with performance in writing are motivation to write, interest in writing combined with confidence in writing skills. On these two factors, the *French/Minority* group had average results slightly lower than the Canadian average.

- The process of consulting (e.g., using the dictionary, other texts) while writing was positively related to performance. On this factor, the *French/Minority* group had an average result higher than the Canadian average.

- The two factors associated with frequency of discussion of written work were negatively related to performance. This type of behaviour therefore appears to be more frequent among students with low performance in writing. The *French/Minority* group, which had the lowest average result in writing, had average results much higher than the Canadian average for these factors.

- The use of computers in writing was positively related to performance and explained 5.1 per cent of the variance. The *French/Minority* group appeared to have fewer opportunities to write on the computer, and their average result for this factor was clearly lower than the Canadian average.

In writing, contextual variables offered little in the way of clues to explain the weak performance of the *French/Minority* group. Francophone students were a little less interested in writing, a little less confident in their skills, used computers less often for writing, and consulted dictionaries and other texts more often than average.

Summary Table 2

Context variable factors linked to reading and writing performance:
type of factor, direction and strength of link, and scope of
difference between the French/Minority group and the Canadian average

Factors	13-year-olds	16-year-olds	Total
B. READING AND WRITING			
1. Reading 1994			
Reading strategies	Highly significant (-)	Significant (-)	Significant (-)
Interest: news		Significant	
Perseverance against difficulties			
Interest: comics, sports, leisure			
Interest: novels			
Time: prov./terr./schools			
Interest: literature			
Interest: leisure and science			
Favourable family environment			
2. Writing 1994			
Computer use	Highly significant (-)		Significant (-)
Interest and confidence			
Time: prov./terr./schools			
Discussion on writing			
3. Reading 1998			
Group 1			
To succeed: talent and luck			
Reliance on teacher			
Reading time			
Dominance of English	Significant (-)	Significant (-)	Significant (-)
Difficulties: consult			
Time: television			
Group 2			
Interest in reading			
Dominance of English	Highly significant (-)	Significant (-)	Significant (-)
To succeed : talent and luck			
Reading on computer	Significant		
Favourable family environment			
Group 3			
Reading strategies	Significant (-)		
To succeed: talent and luck			
Avoidance strategies			
Love of reading			
Frequency: varied materials		Significant	
4. Writing 1998			
Motivation to write			
Consultation			
Discuss texts	Significant		Significant
Dominance of English	Significant (-)	Significant (-)	Significant (-)

Science

It should be noted that in the science domain, the *French/Minority* group has the weakest average results among the four groups of students, for both 13- and 16-year-olds and for both girls and boys. In addition, the difference with respect to the Canadian average is fairly strong in the written component and minimal in the practical tasks component.

Written assessment

- The belief that to succeed in science, they require the support of their parents and teachers was the factor most closely related to performance on the written assessment. This belief is more common among students with low performance, since the factor is negatively related to performance. The belief is stronger among the *French/Minority* group than among all Canadian students.

- The belief that luck is required to succeed was positively associated with performance in the 1999 assessment, but negatively in the 1996 assessment. This positive relationship is somewhat surprising in that it turned out to be negative in every other assessment in which it was measured. In attributing success to luck, the *French/Minority* group had an overall average result equivalent to the Canadian average. In attributing success to effort, the group's result was higher than the average.

- Being generally motivated toward science and placing importance on science as a subject were associated positively with performance. The *French/Minority* group had an average result higher than the Canadian average on the first factor (1996), but lower on the second (1999).

Another characteristic of learners that was negatively related to performance was the tendency to blame teachers for low and failing grades. This trend was much stronger among the *French/Minority* group than among all Canadian students.

Practical assessment

- Time devoted to science homework has a positive relationship. Students in the *French/Minority* group had an average result slightly lower than the Canadian average on this factor.

- *Teaching strategies* is another factor positively related to performance. These strategies include key components such as individual help, active participation in terms of asking questions, the teacher's demonstration of problem solving, and opportunities to discuss the subject of the lesson. On this factor, the *French/Minority* group had an average result higher than the Canadian average.

- Of the six factors associated with learners' characteristics, four had moderately low to low positive relationships. Students who considered science an important subject tended to perform higher. The same was true of students who were satisfied with their performance in science. Strong students had a greater tendency to attribute their success to easy courses and liking school. On the *Satisfaction* and *Success: easy courses* factors, students in the *French/Minority* group recorded slightly higher than average results. On the other hand, their results were slightly lower than the Canadian average for *Liking school* and considering science an important subject.

- In the 1999 assessment, the factor most closely related to performance was that including variables describing asking parents for help (generally speaking, for science homework and other assignments). This behaviour is more frequent among students with low performance, since the factor is negatively related to performance. Students in the *French/Minority* group had a positive result clearly higher than the Canadian average on this factor.

- Two other factors had a positive relationship to performance. These were parents' level of education and access to labs outside of class. The *French/Minority* group average was lower than the average result on the first factor, but higher than average on the second.

Although a very large number of factors including contextual variables were related to performance in science, none explain a major proportion of the variance in performance results. Minority francophone students were interested in science, but paradoxically were less motivated than Canadian students by the various facets of their science courses. Their parents had a level of education a little lower than the Canadian average. These students asked their parents for help less often, discussed their school work with parents less often, and tended more often than the average Canadian student to blame teachers for their low or failing grades.

Summary Table 3
Context variable factors linked to science performance:
type of factor, direction and strength of link, and scope of
difference between the *French/Minority* group and the Canadian average

Factors	13-year-olds	16-year-olds	Total
C. SCIENCE			
1. Written component (1996)			
Courses stimulate interest			
Time: prov./terr. schools			
Consultation			
Motivation			
To succeed: talent and luck			
Clubs and activities			
Teamwork stimulate			
2. Practical tasks (1996)			
Motivation			
3. Written component (1999)			
To succeed: support	Highly significant		
To succeed: luck	Significatif		
Lectures and outings			
Ask help from parents	Highly significant (-)	Highly significant	(-) Highly significant (-)
Blame teacher	Significant	Significant	Significant
Discipline important	Significant (-)		
Scientific experiment		Significant	
To succeed: effort		Significant (-)	
Discuss with parents			
4. Practical tasks (1999)			
Ask parents for help			
Time for homework	Highly significant		Significant
Discipline important	Significant (-)		
Teaching strategies			
Parents' schooling		Significant	
Satisfaction			
Class disturbed	Significant		
Lab outside of classroom		Significant (-)	
Success: easy courses	Significant	Significant	Significant
Lectures and outings			
To succeed: effort	Significant		Significant
Love of school			
Success appreciated: teachers			

5. PEDAGOGICAL CONSEQUENCES ATTACHED TO RESULTS

An analysis of variables associated with student performance on SAIP assessments produces a profile of francophone students in a minority setting in terms of performance in mathematics, reading and writing, and science. This profile describes the typical student, that is, an average student in the *French/Minority* group, and helps in forming a general idea of the characteristics that appear to be common to many students in this group.

Research has identified certain contextual variables associated with the particular performance of the average student in the *French/Minority* group, making it possible to suggest specific pedagogical interventions for each academic subject that might help improve student performance. It would appear obvious, however, that more than pedagogical planning linked to academic subjects is required. A pedagogical approach specific to a minority setting could prove to be a long-term solution to problems of student performance in minority francophone schools in Canada and help end the gradual assimilation and erosion of francophone communities.

5.1 PROFILE OF MINORITY FRANCOPHONE STUDENTS AND POSSIBLE PEDAGOGICAL INTERVENTIONS

5.1.1 Mathematics

In the area of performance, the average student in the *French/Minority* group, whether male or female, differs very little from the typical Canadian student except for a few details. Motivation for mathematics is higher than among Canadian counterparts, and minority francophone students more readily admit that success is linked to individual effort and interest in the subject. They make more use of calculators than do Canadian students, and access computers at least as often as they do, watch more television and videos, and devote less time to homework, although this appears to have no significant effect on performance. Minority francophone students share this characteristic with their Quebec francophone counterparts, who also devote less time to homework, although this does not prevent the latter from achieving the best average performance in Canada. Readers will also recall that the average performance of students in the *French/Minority* group was even slightly higher than that of the *English/Majority* group. We can conclude that the first group's minority language status does not appear to be a disadvantage in mathematics.

The sole pedagogical intervention likely to raise these students' performance in this subject is related to the time spent on homework, and would involve placing more importance on homework. A note of caution, however: students should be encouraged to engage in those activities and gain satisfaction from them, without exerting outside pressure that may adversely affect their motivation, which, it will be remembered, is already higher than average. Any intervention should centre on a student's intrinsic motivation and inner control linked to personal self-determination.

According to Bloom (1976), acquired learning, which consists of all prior learning that is prerequisite to the target learning, is the most important determinant of future learning. Increasing time spent on homework, but especially knowing how to individualize homework

assignments to meet students' particular needs, could have a considerable impact on learning. This approach, which forms an integral part of mastery learning, is particularly well suited to mathematics, where target learning rests on the prior acquisition of specific knowledge and skills. Mastery learning is a pedagogical strategy focused on successful learning for each and every student. This strategy encourages students who are slow learners to complete additional assignments clearly associated with the target learning objectives in their courses, with content placed in a meaningful context.

5.1.2 Reading and writing

Students' daily language experience could not be analyzed in light of SAIP assessments, but the results of those assessments confirm what other studies have reported: typical francophone students in minority settings experience language difficulties. Indeed, the difference between the average student in the *French/Minority* group and the average Canadian student in terms of reading is moderate to high, and very high when compared with students in the majority francophone group. However, minority francophone students stand out most from Canadian students in writing, with very large performance deviations for both males and females and in both age groups, 13 and 16.

What distinguishes francophone students from others in reading? To summarize, they resort less often to cognitive reading strategies, are less persistent in the face of difficulties, and even tend to skirt those difficulties in most cases. They like reading a little less than does the average Canadian student, and reading is encouraged to a low to moderate degree at home. However, their reading interests are clearly diverse; current events in particular interest them more so than their Canadian counterparts, and they are exposed more often than the latter to a variety of texts, including reading on the computer.

The pedagogical intervention most likely to significantly increase their reading performance is the use of cognitive reading strategies in meaningful contexts. Studies have shown that reading performance may be considerably improved when students use cognitive, metacognitive, and socioaffective strategies. Increased training for teachers in this area would prove especially productive given its positive impact on student learning. The idea is to encourage students to realize that there is more than one way to approach and read a text, and that certain approaches work better than others for any given reading goal. Once aware of the fact there are several options available, students will be more disposed to invest time and effort and to experiment. In so doing, students will immediately improve their chances of better understanding what they read and becoming better readers.

In addition, given that students in the *French/Minority* group tend not to persist when encountering difficulties and choose avoidance instead, ways to enhance student motivation for reading merit further attention. Motivation strategies are central, since students must be disposed to learn and have confidence in their abilities before they are able to concentrate on learning new strategies.

This study could not measure the frequency of reading in French compared with reading in English, but studies have shown that many minority francophone students prefer reading in English over reading in French. Promoting reading in French in school and at home therefore is an important issue.

Students in the *French/Minority* group are a little less interested than are Canadian students in writing and a little less confident of their own abilities. They make less use of computers to

write, discuss their written work more often, and consult dictionaries or other works more often, because they experience greater difficulties in this area.

The pedagogical intervention most likely to improve students' performance in writing uses an active pedagogical approach that encourages students to write regularly in meaningful contexts and on subjects that interest them, to instill enjoyment of writing. Any approach based on intrinsic motivation and explicit teaching of effective writing strategies would be appropriate. As in the area of reading, any approach that gives the learner an active role can be applied to writing. Careful use of computers may also help develop skills in and a positive predisposition to writing.

5.1.3 Science

The average student in the *French/Minority* group is motivated by science, but paradoxically, some aspects of science courses are not as stimulating for that student as they are for Canadian counterparts. Students in this group ask parents for help less often and discuss school assignments with them less often as well; readily believe that effort is important to succeed in this subject, but tend more often than the average Canadian student to blame teachers for low or failing grades; are more exposed than the average Canadian student to science experiments and labs outside class, but place less importance on science as a subject; report less often than does the average student being disrupted in class by noise and distractions.

The average student in the *French/Minority* group has greater difficulty with the written assessment than with the practical assessment in science. Research on science education confirms that students in minority language settings may experience difficulties with vocabulary that interfere with their understanding of scientific concepts. Reading difficulties among these students likely are closely associated with difficulties on the written assessment.

An approach that promotes student accountability and encourages students to take responsibility for their own learning would be conducive to developing their scientific skills. Given the vocabulary problems faced by minority francophone students, teachers should be especially vigilant in the use of scientific terminology. Ability in science or math is contingent on ability to speak the language of science or math. Many students may very well learn the concepts associated with learning science at school in English. French terminology in the sciences may seem foreign to francophone students, and hence teaching should give greater consideration to the predominance of English in their day-to-day experience. Approaches that favour experimenting, hands-on use of objects, and discussion might be better suited to these students and cultivate their natural motivation for science. A way must be found not to diminish the cognitive requirements associated with learning science, by understanding, for example, that the learning context is meaningful for students and ensures that there is a thorough and fully developed treatment of the concepts studied in science, while simultaneously helping students feel competent in the subject and sure of themselves.

5.2 TOWARD A PEDAGOGY DESIGNED FOR THE MINORITY SETTING

Analysis of the results of SAIP assessments makes clear the need to do more than pedagogical planning associated with academic subjects. Pedagogical interventions previously described will have a more significant reach if they are integrated into an overall pedagogical approach tailored to the minority community.

In principle, minority francophone students socialized in a French-predominant environment, at least at home, will be able to adapt to French-language schools and benefit fully from the education they receive there, just as students from majority language communities benefit from instruction given in majority-language institutions. A good number of empirical studies, however, demonstrate that the reality of the minority community is the source of subtractive bilingualism for many students and that learning a second language actually weakens their mother tongue. In fact, many students experience a feeling of insecurity toward their own language. To the extent that the proportion of instruction received in French has a clearly positive influence on performance in French while not having a negative effect on performance in English, the didactics of teaching French in minority settings should accord more importance to learning and perfecting students' mother tongue, and promoting additive bilingualism.

The performance of minority francophone students was not the only critical indicator of French-language education in the country. School attendance rates are another, equally important indicator. A special study produced in 2001 for the Office of the Commissioner of Official Languages, *Rights, Schools and Communities in Minority Contexts: 1986-2002: Toward the Development of French Through Education, An Analysis*, notes that only an estimated half of the target school population under section 23(2)(a), that is, children born of parents whose mother tongue is French, is enrolled in French-language schools. The recruitment issue, combined with the performance of minority francophone students, reinforces the need for pedagogy specially designed for French-language schools in minority settings. This will better delineate French-language education, promote it among those entitled to such an education, and effectively take into account the linguistic minority in educational matters.

As described at the beginning of this report (see *Review of the research*, page 7), links exist between the linguistic vitality of francophone communities, students' day-to-day language experience, and their psycholanguage development. The challenges of education and schooling in French in Canada thus appear to be closely linked to the vitality of communities. The weaker a community's vitality, the greater the educational challenge and the more crucial a pedagogical approach tailored to the minority setting.

Pedagogy in minority settings should respond to the twofold educational mission of French-language schools: fully realizing learners' potential and serving the explicit purpose of helping maintain and develop the francophone community. To do this, schools must not only promote academic learning, but also work toward greater social awareness and a higher degree of self-determination of language behaviour and affirmation of identity. The curriculum should extend beyond the traditional academic requirements and take into account the special needs of students in minority settings.

Active acculturation

Acculturation is a process of socialization that promotes the appropriation of cultural components specific to a given group. Students are overwhelmingly exposed to sociocultural models of the dominant English-speaking group, and hence French-language schools must act to maximize opportunities for French-language acculturation. To do this, the curriculum must provide, in addition to *school-specific* activities, activities that take place *from community to school* and *from school to community*.

For *school-specific* activities, this involves ensuring inclusion in the curriculum of specifically French-language components, while approaching the many topics, subjects and issues whose universal character applies to all cultures. Learning science, mathematics, and reading and writing is to draw on the cultural heritage of all humanity. The humanities and social sciences provide opportunities for further study of the contacts between peoples and cultures. It is very important that students have an opportunity to study, analyze, and especially discuss major events, for example, the phenomena that shaped the geography of where they live or events that marked their history. It is especially important that students come to reflect on the facts studied, so they can grasp the meaning of those facts and from their analysis derive the components that affect them personally or concern them as a social and linguistic group.

Activities that take place from community to school may include active participation by members of the community in school and extracurricular activities. For example, a historian might come to the school to retrace the lives of francophones in that region or the province/territory. French-speaking specialists could be invited to meet with students and talk about their career development and achievements. Francophone students who are going on to college or university, or who are highly involved in a particular field, could come and talk to students. The key is for school-age students to be able to relate to role models and be inspired by them. Students should be able to participate actively in the discussion of issues relevant to their lives and futures, and not simply be passive receivers of information.

Activities that take place from school to community may include a wide variety of projects that give students an opportunity to be in direct contact with the reality of their own communities. Conducting interviews, making videos, writing articles, and other media productions all represent learning opportunities. The distribution or presentation of these productions is important for students, who then can share the results of their research and thought with others, leading to greater self-affirmation.

The more family-school-community partnerships are active and extended, the richer and more varied acculturation activities will be.

Developing self-determination

Young francophones in minority settings are not necessarily aware of the pressures exerted by the people around them or their social environment on their day-to-day language experience. However, that experience has a determining influence on their psycholanguage development, that is, their language competence, disposition toward their language community, and behaviour. If the ethnolinguistic vitality of the community in which students live is weak, it will be difficult for them to resist the pressure to assimilate and the social attraction of the majority. We can say in this case that the social determinism at work is predominant.

It thus appears critical to help young people recognize the reality of their linguistic and sociocultural situation and better understand the fragility of their ethnolinguistic identity. Contrary to the traditional academic model, which often effectively introduced «socialization from outside» and control by extrinsic motivation, pedagogy based on developing self-determination attempts to add to the socializing experience of school an experience that «socializes from inside» and cultivates intrinsic motivation. This form of pedagogy is based on the theory of self-determination. This theory, which has been applied in many areas of life, including academic learning, is the object of just as many research studies and has been assessed in practice.

Pedagogy conducive to developing self-determination strives to meet three basic human needs: a *feeling of independence*, a *feeling of competence* and a *feeling of belonging*. Research has shown that individuals who are socialized in contexts promoting the development of these three essential factors tend to be better adapted to their environment and more determined in their behaviour. When individuals act in response to outside pressure, such as various forms of parental or social pressure or for instrumental reasons, such as obtaining a reward, they tend not to maintain that behaviour when the external regulation is no longer present. If, on the other hand, individuals have internalized and integrated the justification for their behaviour, they tend to maintain that behaviour and retain a positive, intrinsic motivation.

To develop a feeling of independence in academic learning, students must perceive that their experience provides them with a certain degree of control and choice and that they themselves are the source of their learning and progress. Learning situations therefore should provide opportunities for students to make choices and exercise their personal motivation. The feeling of competence develops through completion of tasks students find relevant, and which suit their level of knowledge and skills. Lastly, the feeling of belonging is promoted when individuals feel validated and respected in their surroundings. The more those surroundings are welcoming and respectful of the individual, the more that person will be disposed to act independently and participate in group activities. The quality of interpersonal relationships, the learning climate, cooperative learning, and participatory management all contribute to developing a feeling of belonging.

It is important to realize that behaviour maintained only by external pressures will tend to be abandoned in settings where that pressure is no longer present. Considered from this angle, the very future of *la francophonie*, the French-speaking community, will be threatened if the behaviour of reading and writing in French, participation in French-language cultural activities, and the affirmation of a francophone identity are backed only by social pressure from parents and schools. In a social community that promotes the development of feelings of independence, competence, and belonging, individuals will be more naturally disposed to internalize the social norms and values of their community. It is critical that mechanisms be found to prompt students to internalize their francophone experience.

There is no easy recipe for transforming school into an environment likely to promote self-determination. Teacher training should also take place in a climate where feelings of independence, competence, and belonging can be developed, the objective being to introduce the same climate into the classroom and promote self-determination in students through participatory management of the school and the classroom.

Maximum actualization of learning potential

A minority with small numbers must strive for maximum development of its human capital. Creation of a curriculum that promotes mastery learning and is tailored to the minority context will enable a greater number of students to be successful in their studies.

Mastery learning is based on the principle that aptitude is not always a reflection of a student's ability at or limitation in learning, but most often of the pace of learning, that is, the time required to learn. It is also based on the well-documented fact that acquired learning constitutes not only the basis of future learning, but the best instrument for promoting that learning. In other words, when individuals experience the pleasure and satisfaction of mastering something learned, they will be more easily encouraged to proceed further and will want to learn more.

Many studies have shown that when criteria for assessing performance are high and additional opportunities are provided for students to master the target learning, academic performance can be markedly improved. Students should be aware of the criteria that characterize mastery learning, so they will strive for that mastery and not settle for half-measures, be able to see the road ahead, derive full satisfaction from their work when the target objective has been achieved, and recognize the value of effort. Research has clearly shown that high expectations contribute to better learning results than do lower criteria.

Learning activities should be chosen carefully to meet learning objectives. Teachers can draw on textbooks and teacher's guides for activities that are most suitable, but may also adapt those activities and even create others that in their view better promote achievement of the target objective.

It is also important that the assessment be *formative* and *criteria-based*, so that students can learn about their strengths and weaknesses in terms of the learning objectives and the criteria that characterize mastery learning. Through feedback from the assessment, students must be presented with a choice of activities enabling them to progress in their learning and achieve the target objectives. Homework assignments, classroom activities, or after-class activities as part of a tutoring program may be tailored to circumstances and needs identified. This approach proves especially productive when those activities are accompanied by additional opportunities for assessment that enable students to see for themselves the progress they have made and the value of their efforts.

Mastery learning stresses an important aspect of learning, that is, students' accountability, which is linked to the individual's basic needs as defined under the preceding heading (see *Developing self-determination*, page 37). The more the academic environment meets these needs for independence, competence, and belonging, the more students will be personally determined to take charge of their own learning.

Awareness and commitment

Learning in a minority language setting should cultivate an awareness by students of *la francophonie* and the challenges of living in a minority context. This critical awareness of the minority situation of francophones in Canada should be experienced in a climate of dialogue and trust. Students should have opportunities to discuss this major topic openly, express their ideas and emotions toward their own situation, the objective being to make them aware of their personal and social responsibility, and promote self-determination in their language behaviour and affirmation of identity.

In short, today's francophone students must be prepared to become the francophone parents of tomorrow. As parents, they will be much more inclined to take on the choice of educating their own children in French if they themselves have a firm attachment to their language and culture, and if they are convinced of the justification for their convictions and being able to realize their full potential in the Canadian society of tomorrow.

Entrepreneurship and community

A linguistic minority needs to introduce into its family-school-community partnership a spirit of community entrepreneurship among a critical mass of its members to ensure a new generation of leaders capable of working toward the community's historical continuity. For French-language schools, this means cultivating creative thinking, confidence, and leadership among students, to give them opportunities in the course of their education to rub shoulders with leaders in their community who will serve as role models and with whom they can become involved in strategic issues in the community. The curriculum could, for example, make provision for co-op placements and community projects.

In short, the pedagogical interventions suggested at the beginning of this section could help improve the performance of minority francophone students in mathematics, reading and writing, and science. The right choice of classroom interventions, however, will not be enough to remedy the performance problems of students who live in communities whose ethnolinguistic vitality is weak. Developing excellence in pedagogy, part of a comprehensive movement of education in minority settings to achieve additive bilingualism and self-determination in social and language behaviour, appears to be the best way to meet the needs of minority francophone students. These students must indeed develop a genuine intrinsic motivation for the French language in order to succeed at school.

5.3 SECONDARY RESEARCH

Analysis of the SAIP assessments and linking of contextual and performance variables introduced a very large number of variables that can provide a better understanding of academic learning among francophone students living in minority settings. The statistical methods used also provide a better understanding of the results this student group obtained and allow for comparisons with the results for all Canadian students. At the same time, compiling many factors did not always make it possible to detect characteristics specific to the minority francophone group, thereby limiting extrapolation of pedagogical consequences.

To enhance the relevance and usefulness of SAIP data for secondary research, it would be important to strengthen the SAIP database to reflect contextual variables of a sociocultural and language nature, such as parents' mother tongue. Including such contextual information would allow secondary research to draw more useful conclusions in planning and developing policy in the area of French-first-language education.

6. Possible avenues for further research

In the course of this study, a number of possible avenues for further research were identified:

- More detailed studies on minority francophone students in each jurisdiction, particularly with a view to designing, developing, and implementing a comprehensive pedagogical strategy adapted to the minority context.

- A comparative study of the respective language experience of both minority groups, to gain a better understanding of the effects of additive and subtractive bilingualism in a minority setting.

- Studies on different components of pedagogy in minority language communities to reveal, for example, whether teachers favour a pedagogical approach in their practice that promotes self-determination, or instead exert strong external control over learning, whether or not they practise mastery learning, described earlier in broad outline, and to what degree.

- A comparative study of academic programs and educational practices of majority francophone and minority francophone groups to explain in particular the exceptionally strong performance of Quebec francophone students in mathematics.

- A study to support analysis of whether males or females stand out in a significant way on certain contextual variables and to explore the contextual variables related to very large differences in performance between the genders in reading and writing.

Understanding the problem of the minority language experience requires a thorough analysis of the many related variables. Recent SAIP assessments have shown that the experience of minority francophone students was clearly associated with academic performance difficulties. Concerted efforts are essential to meet the challenges of education in minority settings, notably within and between ministries/departments of education, as well as between ministries/departments and their partners and organizations in the education sector.

7. Possible avenues for follow-up

This research report demonstrates the importance of defining pan-Canadian educational projects that will advance development of and research on minority francophone education. Pooling of resources and expertise by all jurisdictions would give everyone the benefit of each authority's knowledge and successes. Projects in areas such as professional training, development of educational and pedagogical resources, and developing intervention strategies could forge partnerships to achieve common objectives of the minority francophone educational community.

In an effort to translate certain avenues for intervention suggested in the research into tangible, practical approaches, a series of ideas for potential pan-Canadian projects has been drawn up around four themes, with the participation of jurisdictions who participated in Segment A of the Pan-Canadian French as a First Language Project.

Teacher Training

Develop and make available to educators a computerized training program on the use of cognitive strategies in reading and writing as part of various subjects to introduce them to pedagogical strategies related to pedagogy by mediation. This resource might include diagnostic tools, pedagogical resources, and motivational strategies that would meet the needs of minority francophone students.

Academic Resources

For minority francophone students:

- Establish a distance assistance network for student assignments that would benefit students and parents who feel disadvantaged in terms of education in French.

- Provide networked writing workshops to give students advice and feedback, as well as contact with French-Canadian writing professionals such as authors and journalists.

For teachers:

- Develop a continuum presenting different steps in acquiring oral competence (from novice to advanced) and a kit on the best ways for students to develop language skills. The resource might include diagnostic tools to determine students' language needs and a set of pedagogical activities and projects to promote a greater mastery of oral language in a variety of communication settings.

- Provide a networked course for Canadian francophones that emphasizes the realities of the minority community, accompanied by pedagogical resources.

Community Resources

- Prepare a model for conducting an awareness campaign among parents to help them better understand the various issues surrounding minority French language education and encourage them to support their children throughout their schooling. The resource guide might suggest the best approaches to outreach to parents, whether francophone or exogamous couples, families headed by a single parent, or newly arrived residents from different ethnic backgrounds.

- Develop a resource guide on the best ways to actively involve young people in strategic issues in their communities and seek their involvement. The guide might suggest tools and activities to promote and maintain rich and varied family-school-community partnerships.

Research

Conduct research to discern differentiated intervention avenues to meet males' needs in reading and writing.

8. CONCLUSION

Analysis of the results of minority francophone students in the School Achievement Indicators Program clearly establishes that they perform below the level of Canadian students in reading, writing and science, subjects requiring a sound knowledge of language. Research confirms that language skills are closely linked to academic performance and that insufficient development of these skills may pose an obstacle to learning, which would partly explain the results obtained by minority francophone students.

The analysis also revealed certain characteristics of these students, such as lower self-confidence and confidence in their ability, less use of cognitive strategies, and more frequent reliance on avoidance strategies. The study suggested avenues for intervention that would contribute to improved academic performance. These interventions would, however, have a broader, more significant scope if they were integrated into a comprehensive pedagogical approach tailored to the minority context, which would better meet the specific needs of minority francophone students.

The will to validate and sustain French-language schools is stronger than ever. A pan-Canadian partnership in French-first-language education, facilitated through the CMEC, is perceived by jurisdictions as a means of meeting the many challenges of minority language education. Continued pan-Canadian exchanges could help consolidate a common and current framework for minority French-language education, define avenues for possible action to improve students' performance and work to carry out common educational projects. The francisation training kit developed as part of the Pan-Canadian French as a First Language Project is the outcome of this sort of cooperation and the result of concerted efforts by jurisdictions across the country. Such projects make a large contribution to each of the participating jurisdictions through the mutual enrichment arising out of their joint work.

The paradigm shift required to meet minority education needs will be possible only if all partners involved contribute to the shift. Educators, parents, and other members of the community all have a specific role to play in developing, maintaining, and enriching French language schools in Canada. The francophone minority owes it to itself to work collectively and concertedly to be better equipped to break out of isolation, meet educational challenges, and promote quality and excellence in its institutions.

9. APPENDICES

Description of the process of statistical analysis

Phase 1: Principal performance data and conclusions

Compiling the results

Tables showing results for each of the 12 assessments contain two kinds of information. First, they provide information on the percentages of students who achieved each of the performance levels on the six-point scale of SAIP assessments (levels 1-5). Note that the ranking below level 1 (< 1) is given to students who did not reach level 1. Second, the table includes, for each student group and overall, an average result and a standard deviation[1] on the six-point scale.

Table 1 below summarizes results for students in the *French/Minority* group on the 1993 SAIP Mathematics assessment (Content). Results for the other three student groups (*French/Majority, English/Minority, English/Majority* have been excluded from the table to simplify the layout.

Table 1
Percentage of students achieving each performance level, average results, and standard deviation (Mathematics 1993: Content)

Group	Age	Gender	< 1%	1%	2%	3%	4%	5%	Average result	Standard deviation
French/ Minority	13	Female	6.1	32.9	36.1	24.7	0.2	--	1.80	0.89
		Male	6.1	31.4	38.4	23.5	0.4	0.1	1.81	0.89
		Total	6.1	32.2	37.2	24.2	0.3	0.0	1.80	0.89
	16	Female	2.1	18.3	22.3	50.6	5.1	1.6	2.43	0.97
		Male	2.7	13.5	24.9	46.1	9.8	2.9	2.55	1.03
		Total	2.4	16.0	23.6	48.4	7.4	2.2	2.49	1.00
Canada	13	Female	6.7	32.9	34.9	25.0	0.5	--	1.80	0.91
		Male	7.1	31.4	34.9	25.5	1.0	0.1	1.82	0.93
		Total	6.9	32.1	34.9	25.2	0.7	0.0	1.81	0.92
	16	Female	3.4	18.7	20.7	47.4	7.0	2.8	2.44	1.06
		Male	3.4	15.5	21.0	45.5	10.1	4.5	2.57	1.11
		Total	3.4	17.1	20.9	46.4	8.6	3.6	2.51	1.09

N.B. Considering the present case of performance levels, student results are distributed around an average value («average result») and deviate more or less around this value («standard deviation»). The limit-distance (above or below the average) is then assessed in standard deviations (or dispersion units). For a normal statistical distribution, 68 per cent of the data fall within less than a standard deviation of the average, 95 per cent within less than two, and 99.9 per cent within less that three standard deviations.

---

[1] *Standard deviation is a unit of statistical measurement that specifies the variability (or dispersion) of a set of data from their average.*

This table supports quick observation of the distribution of performance levels for the four student groups and the entire pan-Canadian sample. Observations from one student group to another can be made on the same principles. As an example, taking the results of **Table 1**, we may observe that:

- From a pan-Canadian viewpoint, a higher proportion of 16-year-old students achieved level 3 or higher (58.6% = 46.4% + 8.6% + 3.6%) than 13-year-old students (25.9% = 25.2% + 0.7% + 0.0%);

- From a pan-Canadian viewpoint, there is no major difference between males and females in the average results, 1.80 at 13 and 2.44 at 16 for females, compared with 1.82 at 13 and 2.57 at 16 for males;

- For the *French/Minority* group, average performances are nearly identical to those obtained by the pan-Canadian sample, as well as by students' age (1.80 vs. 1.81 for 13-year-olds and 2.49 vs. 2.51 for 16-year-olds) and gender (1.81 vs. 1.82 for 13-year-old males and 2.55 vs. 2.57 for 16-year-old males);

- For the *French/Minority* group, performance of two-thirds of the students fell between 0.91 and 2.69 (that is, the average result plus or minus one standard deviation) for 13-year-olds and between 1.49 and 3.49 for 16-year-olds.

Interpreting the results

A statistical analysis technique known as variance analysis[2] was used to verify intergroup differences, the effects of age and gender variables, and interactions among these factors. Two measurements made it it possible to estimate the extent of differences among students in the *French/Minority* group on the one hand, and between this group and the entire Canadian sample on the other.

The first measurement, called relative performance rate, shows the extent to which females or males in the *French/Minority* group compare with females or males in the country as a whole. This is especially useful when there are large differences in performance between females and males. To calculate this measurement, level 3 was set as the standard on the six-point scale of SAIP assessments, except in two specific cases, where level 2 was used as the standard instead of level 3, because of the very low proportion of students who reached level 3 or higher. The relative performance rate is calculated by dividing the percentage of students (females or males, as applicable) in the *French/Minority* group who achieved level 3 in a given subject by the percentage of students (females or males) in the country as a whole who achieved this level. A rate of 1.00 means that students in the *French/Minority* group had a success rate similar to the Canadian rate. A rate lower than 1.00 indicates lower performance, and a rate higher than 1.00 indicates a rate higher than the Canadian rate. These relative performance rates are then compared with those obtained for other student groups, especially the *English/Majority* group.

---

[2] *Variance is another unit of statistical measurement arising out of the calculation of standard deviation, and supports description of the dispersion (or fluctuation) of a set of data. From a mathematical viewpoint, variation corresponds to the average of squares of a standard deviation of a quantity compared with its average value.*

> *Example:* Taking the results of **Table 1** for students in the *French/Minority* group in Mathematics content, the relative performance rate for 13-year-old females is 0.98 (24.9% divided by 25.5%) and the rate for 16-year-old females is 1.00 (57.3% divided by 57.2%). The rates for males are 0.90 for 13-year-olds (24.0% divided by 26.6%) and 0.98 for 16-year-olds (58.8% divided by 60.1%). For this study, relative rates for the *French/Minority* group are higher than for the *English/Majority* group, and hence cannot easily be attributed to the group's minority language status.

The second measurement, standard deviation, allows comparison between the average performance of the *French/Minority* group and that of the country as a whole, and consists of calculating the difference of results in standard deviation units. The measurement consists of calculating the difference between the average result for the *French/Minority* group and the average result for the entire Canadian sample, and dividing this difference by the standard deviation of the Canadian sample. In this study, the scope of this statistical measurement is estimated using the criteria suggested in a study by Wang et al. (1993). These researchers stated that:

- A difference of less than 0.10 standard deviation is considered low;
- A difference of 0.10 to 0.33 standard deviation is considered moderate;
- A difference of more than 0.33 standard deviation is considered high.

> *Example:* Taking the results of **Table 1** for students in the *French/Minority* group in Mathematics content, calculations of differences of results in standard deviation units show that 13-year-old females are at 0.00 standard deviation (1.80-1.80 / 0.91) from the Canadian females' performance, and at -0.01 standard deviation (1.80-1.81 / 0.92) from the Canadian average for all 13-year-old students. Thirteen-year-old males are at -0.01 standard deviation (1.81-1.82 / 0.93) from the average performance for Canadian males, and at 0.00 standard deviation (1.81-1.81 / 0.92) from the average for all 13-year-old students. Calculations for 16-year-old students yield -0.01 and -0.07 standard deviation for females and –0.02 and 0.04 standard deviation for males respectively. In this example, all calculations of differences in results in standard deviation units for the *French/Majority* group fall into the difference bracket considered low (less than 0.10 standard deviation) based on the Wang et al. criteria.

Phase 2: Descriptive analysis of contextual variables

Compiling the results

In an initial table for each SAIP assessment, average results for student groups, divided by age, were recorded for each of the various contextual variables selected. Note that variables deemed irrelevant were excluded, as were a several nominal variables not appropriate to a factorial analysis. The male/female variable was also eliminated because of the very large number of variables to be included in the table.

For example, **Table 2** below summarizes average results for the *French/Minority* group on the 10 contextual variables selected for the 1993 SAIP Mathematics (Content) assessment. Results for the other three student groups *(French/Majority, English/Minority, English/Majority)* were excluded from the table, to simplify the layout.

Table 2
Average results for contextual variables
(1993 Mathematics: content)

| | French Minority | | Canada | | | | Total | |
| | 13 | 16 | 13 | | 16 | | | |
Variable	Average result	Average result	Average result	Standard deviation	Average result	Standard deviation	Average result	Standard deviation
1.1 Confidence in mathematical skills	2.33	2.18	2.21	0.56	2.04	0.60	2.13	0.59
1.2 Attitude toward mathematics	2.24	2.15	2.13	0.62	2.02	0.65	2.08	0.64
2.1 Time: prov./terr. School	4.76	4.78	4.68	0.89	4.73	0.80	4.70	0.85
2.2 Time: Canadian school	4.95	4.96	4.91	0.48	4.91	0.49	4.91	0.49
3.1 Location: calculator	2.54	2.83	2.56	0.68	2.81	0.46	2.67	0.60
3.2 Type of calculator	2.39	3.02	2.35	0.86	2.99	0.87	2.65	0.92
4.1 Time: TV and videos	3.58	3.34	3.53	1.03	3.26	1.06	3.40	1.05
4.2 Time: language of assessment	1.00	1.00	1.72	0.45	1.73	0.44	1.72	0.45
4.3 Hours: mathematics homework	2.24	2.32	2.36	1.25	2.47	1.37	2.41	1.31
4.4 Location: computer	1.20	1.13	1.18	0.46	1.15	0.42	1.17	0.44

These variables were then grouped by principal components in a second table, applying the factorial analysis technique. All variables highly correlated among themselves are thus represented by a certain number of main factors independent of each other, in accordance with the methodological approach explained at the beginning of this section (see *Solution chosen* on page 11). The following example illustrates this operation.

The 10 contextual variables appearing in **Table 2** above are grouped in **Table 3** following under four main factors (referred to as *Motivation, Time: provincial/territorial schools, Use of calculator, and Homework vs. TV*). Factorial analysis in this instance identified these four orthogonal factors that explain 55.6 per cent of the total variation of contextual variables selected for the analysis. Results for the other three student groups (*French/Majority, English/Minority, English/Majority*) were excluded from the table to simplify the layout.

Table 3
Average results for factors grouping contextual variables
(1993 Mathematics: Content)

Factor	French/Minority			Canada	
	13	16	Total	13	16
Motivation	0.67	0.42	0.55	0.13	-0.14
Time: prov./terr. schools	0.05	0.06	0.06	-0.02	0.02
Use of calculator	-0.14	0.55	0.17	-0.32	0.34
Homework vs. TV	-0.97	-0.84	-0.91	-0.09	0.10

Interpreting the results

Average factorial results are expressed in standard deviation. Application of the factorial analysis technique results in a standardization of all factorial student results to yield an average for the entire sample of 0.00 and a standard deviation of 1.00. While average results for the groups may deviate from the 0.00 average either by being positive (higher than the average) or negative (lower than the average), individual results can be readily interpreted in units of standard deviation. For example, a result of 0.30 is 0.30 units of standard deviation higher than the average, while a result of -0.50 is one half a standard deviation below the average. The extent of the difference is also estimated here using the criteria established by Wang et al. (1993) and previously described (see 3.3.2 Phase 2: Descriptive analysis of contextual variables, page 13.)

Summary of results

> *Example:* Taking the results in **Table 3** for the *Motivation* factor, which includes motivational variables 1.1 and 1.2 from **Table 2** (Attitude toward mathematics and Confidence in mathematical skills, respectively), 13-year-old students recorded an average result higher than that of 16-year-old students in the Canadian sample (0.13 vs. -0.14, for a difference of 0.27 standard deviation, considered average by Wang et al.). Also, group interaction by age means that age differences are not all uniform in all groups. Thus, the *French/Minority* group (high difference of 0.55 standard deviation) has a result similar to the result obtained by the *French/Majority* group (high difference of 0.57 standard deviation), but clearly higher than those of the English-language school groups (*English/Minority group* = moderate difference of -0.12 standard deviation and *English/Majority* group = moderate difference of -0.23 standard deviation).

The variance analysis technique, used in the first phase of the analysis, was also applied in this phase to study the nature of observed intergroup differences. Here, variance analyses of groups by age reveal that all the effects measured (group, age, and group interaction by age) are statistically significant. In other words, the methodology chosen made it possible to reduce the number of contextual variables and render them orthogonal.

Phase 3: Relationships between contextual variables and performance

Table 4 below summarizes results of the initial multiple regression analysis for all students in the Canadian sample on the 1993 SAIP Mathematics assessment (Content). Only the explained variance figures were included here, so as to simplify the presentation.

Table 4
Results of multiple regression analysis relating factorial results of contextual variables and performance for all students
(1993 Mathematics: Content)

Factors	Change Statistics Explained Variance
Use of calculator	5.80%
Motivation	5.70%
Homework vs. TV	0.60%
Time: Prov./terr. schools	0.40%
Age	8.50%
Gender	0.10%
Language spoken at home	0.00%

Example: Taking the data shown in **Table 4**, we can state that, statistically speaking, the *Use of calculator* factor, with an explained variance of +5.8%, explains most of the variance in performance. The widespread use of calculators thus appears to be positively related and moderately (since the explained variance is positive and falls between 2 and 16%, using the Wang *et al.* criteria) to student performance in Mathematics content. Similarly, the *Motivation* factor is positively related and moderately to student performance, with an explained variance of +5.7%. Overall, the four factors explain 12.5% of the total variance in performance, and adding the age, gender, and language spoken at home variables increases the explained variance by 8.6%, for a total of 21.1%.

The second multiple regression analysis, performed exclusively with students in the *French/Minority* group, verified whether the factors best predicting performance among all students are the same as those best predicting performance among students in the *French/Minority* group.

Table 5 below summarizes results of the second multiple regression analysis comprising students in the *French/Minority* group for the 1993 SAIP Mathematics assessment (Content). Only the explained variance figures were included here, to simplify the presentation.

Table 5
Results of multiple regression analysis relating factorial results of contextual variables and performance among *French/Minority* group
(1993 Mathematics: content)

Factor	Change Statistics Explained Variance
Use of calculator	4.70%
Motivation	4.10%
Homework vs. TV	1.00%
Time: prov./terr. schools	0.30%
Age	10.10%
Gender	N/A*
Language spoken at home	0.10%

* The explained variance cannot be calculated for this group because average factorial results do not include the male/female variable.

> *Example:* Taking the data shown in **Table 5**, it will be noted that statistically speaking, the factors related to performance among students in the *French/Minority* group do not differ from those related to performance among all Canadian students. In this group, the four factors together explain 10.1% of the total variance in performance, and adding the age, gender and language spoken at home variables increases the explained variance by 10.2%, for a total of 20.3%. As in the regression analysis presented in **Table 4**, the factors of *Motivation* (+4.7%) and *Use of calculator* (+4.1%) explain the greatest proportion of variance among the contextual variables.

Summary Table 1 summarizes the main outcomes of the descriptive analysis of performance. It provides relative rates of performance for boys and girls in the *French/Minority* group, both 13- and 16-year-olds, nine for each SAIP assessment in mathematics, reading and writing, and science. The relative rate of performance shows the degree of comparison between girls or boys in the *French/Minority* group and girls or boys across Canada. In addition, the Summary Table illustrates differences in performance by showing the scope of these differences in standard deviation units from the Canadian average. In this case, boys and girls in the *French/Minority* group are compared to same-gender students (second column) and then to the overall average of all students (third column).

Summary Table 1

Relative performance rates for females and males in the *French/Minority* group and comparisons with the Canadian average in units of standard deviation (size of effect)

	Relative rate (students of same gender)	Size of effect[1] (students of same gender)	Size of effect[1] (all students)
A. MATHEMATICS			
1. Content 1993			
Females - 13	0.98	-0.00	-0.01
Males - 13	0.90	-0.01	0.00
Females - 16	1.00	-0.01	-0.07
Males - 16	0.98	-0.02	+0.04
2. Problem Solving 1993			
Females - 13	0.57 (0.80)[2]	-0.26	-0.26
Males - 13	0.43 (0.70)[2]	-0.38	-0.40
Females - 16	0.71	-0.24	-0.30
Males - 16	0.69	-0.31	-0.26
3. Content 1997			
Females - 13	097	-0.02	-0.03
Males - 13	0.92	-0.08	-0.07
Females - 16	0.96	-0.10	-0.15
Males - 16	0.91	-0.18	-0.14
4. Problem Solving 1997			
Females - 13	1.03 (0.95)[2]	-0.02	-0.01
Males - 13	0.78 (0.89)[2]	-0.11	-0.13
Females - 16	0.88	0.00	0.01
Males - 16	0.89	-0.05	-0.06
B. READING AND WRITING			
1. Reading 1994			
Females - 13	0.91	-0.18	+0.09
Males - 13	0.72	-0.34	-0.60
Females - 16	0.92	-0.28	-0.02
Males - 16	0.77	-0.41	-0.65
2. Writing 1994			
Females - 13	0.49	-0.86	-0.64
Males - 13	0.32	-0.93	-1.12
Females - 16	0.72	-0.66	-0.55
Males - 16	0.48	-0.94	-1.11

[1.] *Size of effect: < 0.10 = low, 0.10–0.33 = moderate, >0.33 = high.*
[2.] *Calculations of relative performance rate using level 2 as standard.*

Summary Table 1 (continued)

Relative performance rates for females and males in the *French/Minority* group and comparisons with the Canadian average in units of standard deviation (size of effect)

	Relative rate (students of same gender)	Size of effect[1] (students of same gender)	Size of effect[1] (all students)
3. Reading 1998			
Females - 13	0.88	-0.18	+0.07
Males - 13	0.82	-0.18	-0.44
Females - 16	0.89	-0.21	+0.08
Males - 16	0.91	-0.12	-0.43
4. Writing 1998			
Females - 13	0.55	-0.86	-0.58
Males - 13	0.37	-0.82	-1.07
Females - 16	0.74	-0.75	-0.56
Males - 16	0.51	-0.91	-1.10
C. SCIENCE			
1. Written Assessment 1996			
Females - 13	0.70	-0.36	-0.34
Males - 13	0.69	-0.37	-0.39
Females - 16	0.84	-0.29	-0.32
Males - 16	0.78	-0.37	-0.34
2. Practical Assessment 1996			
Females - 13	0.70	-0.32	-0.33
Males - 13	0.87	-0.17	-0.18
Females - 16	0.81	-0.33	-0.29
Males - 16	0.85	-0.29	-0.31
3. Written Assessment 1999			
Females - 13	0.68	-0.45	-0.44
Males - 13	0.69	-0.41	-0.43
Females - 16	0.87	-0.31	-0.31
Males - 16	0.81	-0.41	-0.40
4. Practical Assessment 1999			
Females - 13	0.90	-0.11	-0.05
Males - 13	0.87	-0.13	-0.20
Females - 16	0.90	-0.17	-0.12
Males - 16	0.86	-0.24	-0.28

---

[1] *Size of effect: < 0.10 = low, 0.10 –0.33 = moderate, >0.33 = high.*

Summary Table 2 contains a compilation of results for analysis of the relationship between contextual variables and performance of the *French/Minority* group. The contextual variables most closely related to performance measurements in mathematics, reading and writing, and science appear in this table, which also identifies in units of standard deviation the differences between average results for the *French/Minority* group and the Canadian average

Summary Table 2
Factors for contextual variables related to performance in mathematics, reading and writing, and science, type of factor, direction and strength of relationship and size of difference, between *French/Minority* group and Canadian average

Factor	Relationship (%) [2]	13	16	Total
A. MATHEMATICS				
1. Content 1993				
Use of calculator	+ M (5.8)	- 0.14	+ 0.55	+ 0.17
Motivation	+ M (5.7)	+ 0.67	+ 0.42	+ 0.55
Homework vs TV	+ L (0.6)	- 0.97	- 0.84	- 0.91
2. Problem Solving 1993				
Motivation	+ ML (4.3)	+ 0.35	+ 0.04	+ 0.20
Calculator and computer	+ ML (3.1)	- 0.32	+ 0.34	+ 0.00
TV vs Homework	- L (1.4)	+ 0.33	- 0.02	+ 0.16
Time: prov./terr. schools	+ L (1.4)	+ 0.18	+ 0.21	+ 0.20
3. Content 1997				
Consultation	- M (7.4)	+ 0.12	- 0.11	+ 0.01
Succeeding: effort and interest	+ ML (2.0)	+ 0.40	0.43	0.42
Teamwork	+ L (1.9)	0.13	0.13	0.13
Learning strategies	- L (0.6)	- 0.33	+ 0.22	- 0.06
Succeeding: talent and luck	- L (0.5)	0.09	0.21	0.15
4. Problem Solving 1997				
Consultation	- M (6.6)	0.13	- 0.11	0.01
Motivation	+ M (5.2)	0.20	0.07	0.13
Learning strategies	+ L (0.9)	- 0.36	+ 0.25	- 0.06
Succeeding: effort	+ L (0.8)	0.36	0.40	0.38
B. READING AND WRITING				
1. Reading 1994				
Reading strategies	+ M (7.5)	- 0.61	- 0.46	- 0.54
Interest: current events	+ ML (3.4)	0.14	0.46	0.29
Persistence in the face of difficulties	+ ML (3.1)	- 0.11	- 0.16	- 0.13
Interest: comics, sports, recreation	- ML (2.8)	0.28	- 0.01	0.14
Interest: novels	+ ML (2.0)	0.11	- 0.02	0.05
Time: prov./terr. schools	+ L (1.8)	0.14	0.15	0.14
Interest: literary arts	+ L (1.5)	0.06	0.16	0.11
Interests: recreation and science	- L (1.4)	- 0.09	- 0.15	- 0.12
Favourable family setting	+ L (0.5)	- 0.16	- 0.27	- 0.21

Differences in units of standard deviation[1] (column header spanning 13, 16, Total)

[1] *Differences in units of standard deviation: < 0.10 = low, 0.10 to 0.33 = moderate, >0.33 = high.*

[2] *Relationships: between 0.5% and 2.0% = low (L), 2.0% to 5.0% = moderately low (ML), 5.0% to 10.0% = moderate (M) and over 10.0% = moderately high (MH). No high relationship (i.e. higher than 16.0%) was found.*

Note: The percentage of variance explained is shown in brackets in the table.

Summary Table 2 (continued)

Factors for contextual variables related to performance in mathematics, reading and writing, and science, type of factor, direction and strength of relationship and size of difference, between *French/Minority* group and Canadian average

Factor	Relationship (%) [2]	Differences in units of standard deviation[1] 13	16	Total
2. Writing 1994				
Use of computer	+ M (5.1)	- 0.57	- 0.17	- 0.39
Interest and confidence	+ ML (3.2)	0.00	- 0.24	- 0.11
Time: prov./terr. schools	+ L (1.3)	0.12	0.12	0.12
Discussion about writing	- L (1.0)	0.27	0.18	0.23
3. Reading 1998				
Group 1				
Succeeding: talent and luck	- M (5.9)	0.17	- 0.01	0.09
Support from teacher	+ M (5.1)	- 0.25	0.11	- 0.09
Reading time	+ ML (3.5)	0.10	- 0.19	- 0.03
Predominance of English	- ML (3.5)	- 0.51	- 0.51	- 0.51
Difficulties: consulting	- ML (2.3)	0.28	- 0.12	0.11
Time: television	- L (0.9)	0.28	- 0.23	0.05
Group 2				
Interest in reading	+ MH (10.3)	- 0.15	0.13	- 0.01
Predominance of English	- ML (3.0)	- 0.56	- 0.53	- 0.54
Succeeding: talent and luck	- ML (2.4)	0.05	- 0.02	0.02
Reading on the computer	+ ML (2.4)	0.31	0.7	0.19
Favourable family setting	+ L (0.5)	0.11	- 0.09	0.01
Group 3				
Reading strategies	+ MH (12.6)	- 0.41	- 0.12	- 0.28
Succeeding: talent and luck	- ML (3.5)	0.05	- 0.01	0.02
Avoidance strategies	- ML (3.2)	0.16	0.11	0.14
Love of reading	+ ML (2.2)	- 0.06	- 0.11	- 0.08
Frequency: varied texts	+ L (1.0)	0.11	0.32	0.20
4. Writing 1998				
Motivation to write	+ M (6.5)	- 0.05	- 0.17	- 0.11
Consulting	+ ML (2.7)	0.13	0.13	0.13
Discussing texts	- L (1.3)	0.54	0.18	0.37
Predominance of English	+ L (1.3)	- 0.87	- 0.84	- 0.86

[1.] *Differences in units of standard deviation: < 0.10 = low, 0.10 to 0.33 = moderate, >0.33 = high.*
[2.] *Relationships: between 0.5% and 2.0% = low (L), 2.0% to 5.0% = moderately low (ML), 5.0% to 10.0% = moderate (M) and over 10.0% = moderately high (MH). No high relationship (i.e. higher than 16.0%) was found.*
Note: The percentage of variance explained is shown in brackets in the table.

Factors for contextual variables related to performance in mathematics, reading and writing,
and science, type of factor, direction and strength of relationship and size of difference,
between *French/Minority* group and Canadian average

Factor	Relationship (%) [2]	Differences in units of standard deviation[1]		
		13	16	Total
C. SCIENCE				
1. Written Assessment 1996				
Courses stimulate interest	+ ML (4.4)	- 0.28	- 0.01	- 0.17
Time: prov./terr. schools	+ ML (4.2)	0.09	0.15	0.12
Consultation	- ML (3.8)	0.05	- 0.05	0.01
Motivation	+ ML (3.4)	0.29	0.04	0.18
Succeeding:				
talent and luck	- ML (2.3)	- 0.01	0.01	0.00
Clubs and activities	- ML (2.0)	0.26	0.05	0.17
Teamwork stimulates	- L (1.4)	0.16	- 0.20	0.01
2. Practical Assessment 1996				
Motivation	- L (0.7%)	0.29	- 0.06	- 0.14
3. Written Assessment 1999				
Succeeding: support	- M (7.1%)	0.70	- 0.10	0.21
Succeeding: luck	+ ML (4.1%)	0.31	- 0.12	0.04
Guest speakers				
and field trips	+ ML (2.5%)	0.05	- 0.23	- 0.12
Asking parents for help	+ L (1.7%)	- 0.91	- 0.77	- 0.82
Blaming teacher	- L (1.4%)	0.47	0.34	0.39
Major discipline	+ L (1.1%)	- 0.39	- 0.09	- 0.20
Science experiments	+ L (0.7%)	- 0.01	0.30	0.18
Succeeding: effort	+ L (0.06%)	- 0.01	- 0.38	0.23
Talking to parents	+ L (0.6%)	- 0.29	- 0.08	- 0.16
4. Practical Assessment 1999				
Asking parents for help	- M (5.1%)	0.76	0.02	0.30
Homework time	+ ML (4.9%)	- 0.37	0.07	0.10
Major discipline	+ ML (2.1%)	- 0.21	- 0.03	- 0.10
Teaching strategies	+ L (1.9%)	- 0.07	0.32	0.17
Parents' educational level	+ L (1.8%)	0.06	- 0.28	- 0.15
Satisfaction	+ L (1.2%)	0.46	- 0.11	0.11
Disrupted class	- L (1.0%)	- 0.06	- 0.41	- 0.28
Lab outside class	+ L (1.0%)	0.36	0.45	0.42
Succeeding: easy courses	+ L (0.8%)	0.08	0.09	0.08
Guest speakers				
and field trips	- L (0.8%)	0.38	0.29	0.32
Succeeding: effort	- L (0.6%)	0.19	0.03	0.09
Liking school	+ L (0.6%)	0.03	- 0.17	- 0.09
Success valued: teachers	- L (0.5%)	- 0.18	- 0.18	- 0.18

[1.] *Differences in units of standard deviation: < 0.10 = low, 0.10 to 0.33 = moderate, >0.33 = high.*

[2.] *Relationships: between 0.5% and 2.0% = low (L), 2.0% to 5.0% = moderately low (ML), 5.0% to 10.0% = moderate (M) and over 10.0% = moderately high (MH). No high relationship (i.e. higher than 16.0%) was found.*

Note: The percentage of variance explained is shown in brackets in the table.

Only contextual variable factors explaining at least 0.5% of the variance in performance outcomes are shown in the table. The relationship between a factor and performance is described as positive (+) or negative (-) depending on whether it is associated with an increase or a decrease in the performance outcome. Based on criteria set by Wang et al. (1993), relationships that explain between 2.0 and 16% of variance are considered moderate and relationships that explain more than 16% of variance are considered strong. Relations that explain between 0.5 and 2.0% of variance are considered weak. However, none of the factors explains more than 12.6% of variance in this research. Therefore, subcategories have been created to describe moderate relationships. The importance of relationships is thus estimated based on the following criteria:

- Any relationship explaining between 0.5 and 2.0% of variance is described as weak (L);

- Any relationship explaining between 2.0 and 5.0% of variance is described as moderately weak (ML);

- Any relationship explaining more than 5.0 and up to 10.0% of variance is described as moderate (M);

- Any relationship explaining more than 10.0% of variance is described as moderately strong (MH).

Finally, the differences between the *French/Minority* group and the Canadian average in terms of average results for factors involving context variables are shown and are expressed in standard deviation units for 13-year-olds and 16-year-olds and the overall group. A positive result means that the *French/Minority* group have an average result on a factor that is higher than the Canadian average and a negative result indicates that the average result is lower than the Canadian average. A difference is considered weak if lower than 0.10, moderate if between 0.10 and 0.33, and strong if over 0.33.

Note: The percentage of variance explained is shown in brackets in the table.

Phase 1: Main performance data

SAIP mathematics assessments (1993 and 1997)

In 1993, the average performance of *French/Minority* group students in mathematics content is very similar to the average performance of the Canadian sample. The average rate of performance is either equal to 1.00, i.e., equivalent to the Canadian average, or very close. When differences are expressed in standard deviation units, the size of the effect is very small, for both boys and girls, between -0.07 to +0.04 standard deviation.

The descriptive analysis of performance outcomes also shows that the average result of students in the *French/Minority* group is even slightly higher than those of the English majority group and that the *French/Majority* group shows performance considerably higher than the Canadian average.

Performance of students in the *French/Minority* group and problem-solving is not as strong as in mathematics content for the 1993 assessment. Relative performance rates for girls and boys are weak in both age groups and deviations from the Canadian average range from -0.26 to 0.40 standard deviation, i.e., moderately strong to strong differences according to the chosen reference criteria (Wang et al., 1993).

In 1997, deviations in performance in mathematics content between the *French/Minority* group and the overall Canadian sample are slightly larger than in 1993. Relative rates of performance are all higher than 0.90 and deviations in units of standard deviation are very weak to moderate, ranging from -0.02 to -0.18.

The detailed descriptive analysis of performance outcome also shows that the average performance of the *French/Minority* group is slightly higher than that of the *English/Majority* group. Deviations from the Canadian average are explained more by the higher performance of the two Quebec groups (*French/Majority* and *English/Minority*) than by a lower performance of minority-setting francophone.

The performance of the *French/Minority* group students in problem-solving is significantly higher than in 1993. Some relative rates are slightly lower than 0.90 and for 13-year-old boys, the average deviation is slightly higher than 0.10 standard deviation. Nonetheless, those results are equivalent to those of the *English/Majority* group based on the descriptive performance analysis of all four groups of students.

The analysis of mathematics data does not show any weakness specific to the minority-setting francophone group, given that the performance of students of this group is similar in many respects to that of the Canadian sample and slightly higher than that of the majority-setting anglophones. In addition, minority-setting francophones display clearly higher performance than the average for Canada. Therefore, the gap between the performance of minority-setting francophones and the Canadian sample is attributed more to the high performance of francophones and anglophones in Quebec than to lower performance by minority-setting francophones. It would appear that the differences observed cannot be attributed to the linguistic status of minority-setting francophones.

SAIP reading and writing assessments (1994 and 1998)

Writing is the major weakness of minority-setting francophone students. Nonetheless, difficulties ranging from moderate to strong are also found in reading for the *French/Minority* group.

Girls' performance in reading is higher than that of boys in the 1994 assessment. Their relative performance rates are higher than 0.90 where boys' rates are 0.72 and 0.77 for 13- and 16-year-olds respectively.

It should be noted that in reading, both the *French/Minority* group and the Canadian sample, girls' average performance is clearly higher than boys'. This is why performance deviations expressed in standard deviation units among girls in the *French/Minority* group are stronger when compared to the performance for all of Canada (-0.18 and -0.28 for 13- and 16-year-old girls respectively) than when compared to the overall of Canadian sample (+0.09 and -0.02 for 13- and 16-year-old girls respectively). In other words, boys' lower performance brings down the Canadian average. The situation is reversed among boys in the *French/Minority* group who compare more favourably to boys across Canada (-0.34 and -0.41 for 13- and 16-year-old boys respectively) than to the overall Canadian sample (-0.61 and -0.65 for 13- and 16-year-old boys respectively).

The same trends can be observed in reading for the 1998 assessment as well for both writing assessments. In both domains, girls' average performance is clearly higher than boys'. Thus it appears more appropriate to estimate differences on performance by comparing girls with girls and boys with boys. Thus, in 1994, reading difficulties range from moderate (13-year-olds) to moderately strong (16-year-olds) among girls and are strong among boys regardless of age.

In 1998, boys appear to have improved their relative performance; however, it should be noted that this improvement is partly explained by lower outcomes for boys across Canada. Differences in performance between the *French/Minority* group and all Canadian students are moderate when girls in the group are compared to girls of the Canadian sample and range from moderate (13-year-olds) to moderately weak (16-year-olds) when boys in the group are compared to all boys. However, given girls' overall higher average performance, differences can be considered strong when the performance of boys is considered to that of all Canadian students.

In writing, performance differences, both in 1994 and in 1998, can be considered very strong. Relative performance rates for boys are very weak, ranging from 0.32 in the 13-year-old group in 1994 to 0.51 in the 16-year-old group in 1998. These rates mean the proportion of boys in the *French/Minority* group reaching level 3 in writing ranges from a third to half of the proportion reaching that standard of the entire Canadian sample. On girls, these rates range from 0.49 for 13-year-olds in 1994 to 0.74 for 16-year-olds in 1998. However, when differences are expressed in standard deviation units, the weakest difference is two-thirds of a standard deviation (-0.66) in comparisons between genders. Differences are higher than on standard deviation among boys when their performance is compared to the Canadian average of boys and girls combined.

While differences between the *French/Minority* group and the Canadian sample are less strong in reading than in writing, it should nonetheless be noted that performance in reading in French is even weaker when compared to the average performance of students in the *French/Majority* group.

SAIP science assessments (1996 and 1999)

Performance differences between boys and girls are very weak. Therefore, differences expressed in standard deviation units are similar, whether the comparison is with students of the same gender in the Canadian sample or with the entire Canadian sample.

In the practical tasks science component, the overall relative performance of the *French/Minority* group is slightly higher than in the written component. In addition, the 1999 performance of girls appears higher than in 1996. When girls are compared to the overall Canadian sample, differences are strong in 1996 (-0.33 and 0.29 standard deviation among 13- and 16-year-olds respectively) but rather weak in 1999 (-0.05 and -0.12). Among boys, the difference from the Canadian average in 1996 is moderate among 13-year-olds (-0.18) and rather strong among 16-year olds (-0.31). In 1999, the deviation was moderate among 13-year-olds (-0.20) and moderately strong (-0.28) for 16-year-olds.

In summary, the descriptive analysis of performance in the written component of the science assessment shows that the *French/Minority* group has the weakest average results among the four groups of students, for both 13- and 16-year-olds and for both girls and boys. In addition, based on the criteria used, the difference with the Canadian average is rather strong. The difference is weaker in the practical tasks component.

Summary

An analysis of student performance on SAIP assessments shows that minority-setting francophone students show lower performance than their anglophone counterparts in the same jurisdictions or than the Canadian sample mostly in subjects where use of the French language plays a major role, i.e., writing, reading and science (written assessment). The situation does not seem to be as alarming in mathematics, where minority-setting francophone students perform often as well and sometimes at a higher level than anglophone students in their respective jurisdictions and in the Canadian sample.

APPENDIX V

PHASES 2 AND 3: MAIN DATA ON CONTEXT VARIABLES

Mathematics

The average results for the *French/Minority* group in mathematics tend to be very close to the Canadian average. A total of 16 relationships between context variable factors in mathematics performance explain at least 0.5% of variance. It can be seen that some factors are the same from one assessment to the next, e.g., *Motivation* or very similar, e.g., *Use of calculator* and *Calculator and computer*).

The behaviour of the *Consultation* factor (consulting the teacher, other students, or others) is negatively correlated with performance in mathematics content, and problem solving. This factor explains the largest variance (7.4 and 6.6%). This suggests that the problem may not lie with *Consultation* but rather with the fact that weaker students are more likely to ask for help. Students in the *French/Minority* group are not dissimilar from others in respect of this factor since their average results are very close to the Canadian average.

The *Motivation* factor includes two variables: attitude toward mathematics and confidence in mathematic skills and is twice linked moderately and once moderately weak to mathematics performance. It explains on average 5.1% of deviation. The *French/Minority* group has the higher average result than the Canadian average on each occasion. Since this factor is positively correlated to performance, it involves the characteristic that encourages higher level of performance in the minority-setting francophone group.

Another motivational-type factor, *To succeed: effort and interest*, denotes the belief that success requires effort in studying mathematics. This factor is positively correlated to performance in mathematics content (2.0% of variance explained) and in problem solving (0.8%) in the 1997 SAIP assessment. It should be noted that in respect of this factor, the *French/Minority* group displays significantly higher results than the Canadian average.

A third factor related to motivation, *To succeed: talent and luck*, has a very weak negative relationship with performance on mathematics content (0.5% of variance explained). This belief is slightly stronger among students in the *French/Minority* group than in the overall Canadian sample.

Access to sophisticated calculators (programmable and with graphical display) and to computers is positively related to performance in the 1993 SAIP assessment. The strength of the relationship ranges from moderately weak (3.1% of variance explained) to moderate (5.8%). In respect of this factor, students in the *French/Minority* group have average results that are either equal to or higher than the Canadian average. Use is lower among 13-year-old students, which matches the Canadian trend.

Time dedicated to homework rather than television is positively related to performance but only explains a small part of the variance. Time devoted to homework explains 0.6% of the variance in mathematics content and devoting more time to television than to homework is negatively related to problem-solving performance, explaining 1.4% of variance. On the *Homework vs. TV* factor, the *French/Minority* group has a clearly lower result than the Canadian average, while it shows a higher result on the *TV vs. homework* factor. It would therefore appear that time devoted to homework is lower than average in the *French/Minority* group. It should be noted, however, that these factors only explain a small part of the variance.

Teamwork is positively correlated with mathematics content performance (1.9% of variance explained). In respect to this factor, the *French/Minority* group has an average result that is moderately higher than the Canadian average. This is another characteristic that is favourable to the group.

The *Learning strategies* factor involves rather traditional strategies: the teacher explains the method, the student copies it down from the blackboard and works individually to solve problems. This classroom approach appears to have fairly neutral effects given the weak relationship of this factor to performance.

Finally, the factor related to time spent in provincial/territorial schools is positively correlated with performance. It seems that students attending schools more recently in Canadian provinces/territories have lower performance levels. It should be noted, however, that this factor only explains 1.4% of the total variance. In addition, the *French/Minority* group is not disadvantaged on this point since its average result is higher than the Canadian average.

In respect of those context variables most strongly associated with mathematics performance, the average minority-setting francophone students display very little difference from other Canadian students. They do not seem to be disadvantaged by their minority language status. The only factor separating francophone from anglophone students is less time devoted to homework, in both the minority-setting and in Quebec.

Reading and writing

It should be recalled that the *French/Minority* group displays the weakest performance compared to all Canadian students in reading and writing, with the differences especially pronounced in writing. Factors involving context variables in reading and writing are shown in order of their impact on performance for each of the self-assessments in 1994 and 1998. Some factors are repeated because of similar questions on questionnaires for all SAIP assessments related to reading and writing, and also given the presence of three different groups of students who answered a common section of the questionnaire in the 1998 assessment.

Reading

The use of cognitive reading strategies to enhance understanding of the text and validate interest in the text is positively correlated to performance in this domain. The relationship ranges from moderate (7.5% of variance explained) to moderately strong (12.6% of variance explained). In respect of this factor, the *French/Minority* group shows clearly lower average results than the Canadian average. Another type of cognitive strategy in reading, the use of avoidance strategies (e.g., avoid non-familiar words, give up when faced with difficulties) shows a negative and moderately weak relationship to performance (3.2% of variance explained). The *French/Minority* group uses this type of strategy more often than the Canadian average.

Several factors related to reading performance are motivational in nature. Interest in a variety of reading types is positively correlated with performance results: interest in news, novels, and literature. These factors explain between 1.5 and 3.4% of variance. Overall interest in reading (group 2, 1998 SAIP assessment) displays a moderately strong positive relationship to performance and explains 10.3% of variance. On this factor, the *French/Minority* group shows results equivalent to the Canadian average.

On the other hand, certain types of interests are negatively correlated with reading performance: interest in comics, sports, and leisure as well as leisure and science. Relationships

between performance and factor results measuring varied interests do not necessarily mean that certain types of interests increase reading performance while others decrease it. More likely, these relationships are due to the fact that the interests of students who were stronger in reading are different from those who are weaker. However, it appears reasonable to assume that a general interest in reading and frequency of reading contribute over the long term to enhancing reading competency. The *French/Minority* group displays average results higher than the Canadian average in respect of interest in news, interest in comics, sports and leisure, and interest in literature. The group's average result is slightly lower than the Canadian average in respect of interest in leisure and science. Interest in novels and in reading in general is very similar to that of all Canadian students.

The *Love of reading* factor is another indicator of general interest in reading (group 3, 1998 SAIP assessment). This factor shows a moderately weak relationship with performance (2.2% of variance explained). The *French/Minority* group shows an average result that is slightly lower than the Canadian average in respect of this factor.

Certain number of beliefs related to the factors linked to success in reading show relationships ranging from moderate to moderately weak performance. The belief that success in reading is attributable to luck or talent is negatively correlated with reading performance on three occasions (1998 SAIP assessment). In two cases (group 2 and group 3), the average result of the *French/Minority* group is very close to the Canadian average and in the third case (group 1) the average result is slightly higher than the Canadian average.

The *Reliance on teacher* factor denotes the belief that a good teacher is required for success; this belief is combined with not consulting a dictionary or not asking for explanations and not giving up when faced with difficulties. This factor, which appears to reflect students' confidence in their teacher, is positively correlated with performance and explains 5.1% of variance. On this factor, the *French/Minority* group shows a slightly lower average result than the Canadian average.

Another motivational factor is perseverance when faced with difficulties. This factor shows a positive and moderately weak relationship with performance (3.1% of variance explained). The average result of the *French/Minority* group is moderately lower than the Canadian average on this factor.

The *Reading time* factor, referring to the time devoted to reading, is positively correlated with performance and shows a moderately weak relationship with performance (3.5% of variance explained). The *French/Minority* group is not different from other students in respect of this factor. However, a moderately weak result can be observed for 16-year-old students in this group.

The frequency of consultation related to difficulties encountered in reading (2.3% of variance explained) is negatively correlated with performance. However, this is not a cause and effect relationship between consultation and performance, but rather the fact that students who are weaker in reading tend to consult more. The slightly higher-than-average result for the *French/Minority* group may be explained by lower-than-average performance in this group.

The frequency of contact with varied texts is positively associated with performance but only explains 1.0% of variance. The average result for the *French/Minority* group on this factor is higher than the average.

In respect of the *Favourable family environment* factor, the average result for the *French/Minority* group is lower than the Canadian average in 1994 but equal to the Canadian average in 1998. In respect of the *Reading on the computer* factor, the average result of the *French/Minority* group is higher than the Canadian average. Living in a family environment favourable to reading bears a weak positive relationship to performance (0.5% of variance explained), while opportunities to read on the computer display a moderately weak relationship with performance (2.4% of variance explained).

Finally, time devoted to watching television is negatively correlated to performance but only explains 0.9% of the variance. On this factor, the average result for the *French/Minority* group is close to the Canadian average. This result is higher for 13-year-olds and lower for 16-year-olds, which is consistent with pan-Canadian results.

In summary, in respect of those variables most strongly related to reading performance, minority-setting francophones are set apart by their less-frequent use of cognitive strategies in reading, by their lower perseverance when faced with reading difficulties, and by their greater use of avoidance strategies.

Writing

In both SAIP writing assessments, eight relationships explain at least 0.5% of variance. The characteristic most strongly associated with writing performance is motivation to write (6.5% of variance explained), while the second-strongest is related to a motivational factor (3.2% of variance explained) i.e., interest in writing combined with confidence in writing skills. On those two factors, the average results of the *French/Minority* group are slightly lower than the Canadian average.

Consulting (e.g., a dictionary, other texts) while writing is positively related to performance. The relationship observed is moderately weak (2.7% of variance explained). On this factor, the average result of the *French/Minority* group is higher than the Canadian average. The two factors associated with frequency of discussion about written material are negatively correlated with performance. It appears that this type of behaviour is more frequent among students displaying weaker writing performance. Indeed, the *French/Minority* group shows both the weakest average result in writing and strongly higher average results than the Canadian average in respect of these factors.

The use of a computer for writing is positively correlated to performance and explains 5.1% of variance. The *French/Minority* group appears to have fewer opportunities to write on the computer, given that its average result on this factor appears lower than the Canadian average.

As in reading, time spent in schools in the province/territory is positively correlated with writing performance (1.3% of variance explained). On this factor, the result for the *French/Minority* group is however slightly higher than the Canadian average.

In writing, context variables offer few clues to explain the weak performance of the *French/Minority* group. Francophone students are slightly less interested in writing, slightly less confident in their skills, use a computer less often to write, and consult dictionaries and other texts less often than the Canadian average.

Science

In science, a total of 30 relationships explain 0.5% or more of variance.

Written assessment

Among factors describing learners' characteristics, the belief that support from parents and teachers is required to succeed in science is most strongly correlated to performance on the written assessment. The relationship is moderate (7.1% of variance explained). This belief is more frequent among students with weaker performance, given that the factor is negatively correlated with performance. This belief is stronger in the *French/Minority* group and for all Canadian students.

The belief that luck is necessary to succeed shows a positive association with performance in the 1999 assessment (4.1% of variance explained), but negative (2.3%) in the 1996 assessment. This positive relationship is rather surprising since it has been negative in all other assessments in which it had been measured. On the other hand, as in other assessments, the belief that effort brings success is positively associated with performance but only explains 0.6% of variance. In respect of the belief that success is explained by luck, the *French/Minority* group shows an overall average result equivalent to the Canadian average. The results of this group are higher than average in respect of the belief that success is explained by effort.

The general belief that sciences are motivating (3.4% of variance explained) and the belief that science as a discipline is important (1.1%) are positively associated with performance. The *French/Minority* group has an average result that is higher than the Canadian average for the first factor (1996) but lower for the second (1999).

Another learner characteristic that is negatively related to performance (1.4% of variance explained) is the tendency to blame the teacher for low marks and failure. This tendency is much stronger among the *French/Minority* group than for all Canadian students.

Other factors are positively correlated with performance: a course that stimulates interest in science (4.4% of variance explained), the frequency of lectures and outings (2.5%), requesting help from parents (1.7%), and discussing work in science with parents (0.6%), as well as the frequency of scientific experiments (0.7%). The average results for students in the *French/Minority* group are lower than the Canadian average on each of these factors, except for the frequency of scientific experiments. The difference is particularly strong in respect of the frequency of requesting help from parents.

Three other factors are negatively correlated with performance on the written assessment: the frequency of consulting, being stimulated by group work, and participating in clubs and activities. In other words, it appears that these characteristics are more frequent among weaker students. Students in the *French/Minority* group participate more often than the Canadian average in clubs and activities but are not distinct from other students in respect of the other two factors.

Finally, time spent in provincial/territorial schools is positively correlated with performance, as in all other SAIP assessments. The average result of the *French/Minority* group is slightly higher than the Canadian average in respect of this factor.

Practical tasks

In the 1996 assessment measuring science performance in practical tasks, a single factor, *Motivation*, meets the minimum criterion for explained variance. The relationship between this factor and performance is weak (0.7% of the variance explained) and is negative. This unexpected

relationship could be attributed to the fact that predicting results in practical tasks for 1996 is very weak (only 1.8% of variance explained by a total de 10 factors). The average result for students in the *French/Minority* group in respect of the *Motivation* is moderately higher than average.

In the 1999 assessment, a total of 13 factors meet the criterion of 0.5% or more of variance explained in the practical tasks assessment. The factor the most strongly correlated to performance is the one that involves variables describing requesting help from parents (in general, for science and other homework). This behaviour is more frequent among students with weaker performance since the factor is negatively correlated to performance. The relationship is moderately strong (5.1% of variance explained). Students of the *French/Minority* group display a positive result that is clearly higher than the Canadian average in respect of this factor.

Time devoted to science homework bears a moderately weak relationship to performance (4.9% of variance explained). As expected, the relationship is positive. The average results of the *French/Minority* group students are slightly lower than the average in respect to this factor.

The *Teaching strategies* factor is also positively correlated with performance. Such strategies include important components such as individual assistance, active participation involving asking questions, the teacher demonstrating problem-solving, and opportunities to discuss the subject of the lesson. This dynamic approach explains 1.9 % of the variance of the performance. On this positive factor, however, the *French/Minority* group displays a higher average result than the Canadian average.

Two other factors are negatively correlated with performance. Being disturbed in class by noise or distractions has a weak relationship with performance (1.0% of the variance explained), as well as the frequency of lectures and outings (0.8%). It is not clear why the relationship with performance is negative for the practical tasks assessment when it is positive for the written assessment. The average results for the *French/Minority* group students are higher than the Canadian average in respect of the *lectures and outings* factor, but lower than the average for the group that participates in the written assessment.

Out of the six factors associated with learners' characteristics, four bear moderately weak to weak positive relationships. A student who believes that science is an important discipline tends to have higher results (2.1% of variance explained). The same applies to students who are satisfied with their science performance (1.2%). Strong students are more likely to attribute their success to easy courses (0.8%) and to love of school (0.6%). On the factors *Satisfaction and Success: easy courses*, students in the *French/Minority* group have slightly higher-than-average results. On the other hand, their results are also slightly lower than the Canadian average in respect of *Love of school* and believing that science is an important discipline.

Two factors associated with learners' characteristics bear a negative relationship to performance: the belief that effort is required to succeed in science (0.6% of variance explained), and that the success is appreciated by teachers. These two relationships are rather atypical since they are positive in the analysis of performance on the written assessment. The average results for students in the *French/Minority* group are slightly higher than the Canadian average in respect of the factor *To succeed: effort* but lower than the average on the factor *Success is appreciated: teacher*.

Two other factors bear a positive relationship with performance: *Parents' schooling* ((1.8% of variance explained) and *Access to a laboratory outside the classroom* (1.0%). The average result for the *French/Minority* group is lower than average in respect of the first factor but higher than average in respect of the second.

Although a very large number of factors involving context variables are related to science performance, none of them explain the major portion of the variance and performance results. Minority-setting francophone students are interested in science but, ironically, are less motivated than all Canadian students by the varied aspects of their science courses. Their parents' schooling is slightly lower than the Canadian average. These students request help less often from their parents, talk to them less often about their school work, and are more likely than the average Canadian student to blame the teacher for their low marks and failures.

10. ABRIDGED BIBLIOGRAPHY

ANDERSON, S. A. *Synthesis of research on mastery learning*, Michigan, 1994. (ERIC Document Reproduction Service No. ED 382567)

BLOCK, J. H., H. E. EFTHIM, and R. B. BURNS. *Building effective mastery learning schools*, New York, Longman, 1989.

BLOOM, B. S. *Human characteristics and school learning*, New York, McGraw Hill, 1976.

BOUDREAU, A. «Les mots des jeunes Acadiens and Acadiennes du Nouveau-Brunswick,» in L. Dubois and A. Boudreau, *Les Acadiens et leur(s) langue(s) : quand le français est minoritaire*, Moncton, Éditions d'Acadie, pp. 137-155, 1996.

BUSSIÈRE, P., F. CARTWRIGHT, R. CROCKER, X. MA, J. ODERKIRK, and Y. ZHANG. *À la hauteur : La performance des jeunes du Canada en lecture, en mathématiques et en sciences : Étude PISA de l'OCDE — Premiers results pour les Canadiens de 15 ans*. Ottawa, Department of Industry, 2001.

CASTONGUAY-LEBLANC, Y. «Savoir écrire en 9ᵉ année au Nouveau-Brunswick francophone», *La lettre de la DFLM (didactique du français langue maternelle)*, Vol. 19, pp. 14-17, 1996.

CAZABON, B. «L'enseignement en français langue première en situation minoritaire,» *Revue des sciences de l'éducation*, Vol. XXIII, pp. 483-508, 1997.

CAZABON, B. «La recherche en enseignement et en apprentissage du français. De la recherche didactique et pédagogie du français et en français en milieu francophone minoritaire : Bilan de recherche,» *Actes du Colloque pan-Canadian sur la recherche en éducation en milieu francophone minoritaire : Bilan et prospectives*, 2002. On line at http://www.acelf.ca/publi/crde/index.html.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Report on Mathematics Assessment 1993*, Toronto, CMEC, 1993.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Reading and Writing Report 1994*, Toronto, CMEC, 1994.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Report on Science Assessment 1996*, Toronto, CMEC, 1996.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Report on Mathematics Assessment 1997*, Toronto, CMEC, 1997.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Reading and Writing Report 1998*, Toronto, CMEC, 1999.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP): Report on Science Assessment 1996*, Toronto, CMEC, 2000.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *School Achievement Indicators Program (SAIP), Science learning: the Canadian context 1999*, Toronto, CMEC, 2000.

COUNCIL OF MINISTERS OF EDUCATION, CANADA. *Report on Mathematics III Assessment 2001, School Achievement Indicators Program (SAIP)*, Toronto, CMEC, 2002.

CUMMINS, J. *Language, power and pedagogy*, Clevedon, England, Multilingual Matters, 2000.

DECI, E. L. and R. RYAN. «The 'what' and 'why' of goal pursuits: Human needs and the self determination of behaviour,» *Psychological Inquiry*, Vol. 11, pp. 227-268, 2000.

DECI, E. L. and R. RYAN. *Handbook of self-determination research*, Rochester, NY, University of Rochester Press, 2002.

D'ENTREMONT, Y. «L'enseignement des mathématiques en milieu minoritaire: la situation albertaine,» *Actes du colloque pan-Canadian sur la recherche en éducation en milieu francophone minoritaire: Bilan et prospectives*, 2002. On line at http://www.acelf.ca/publi/crde/index.html.

EDUCATION QUALITY AND ACCOUNTABILITY OFFICE. *Third International Mathematics and Science Study Repeat Project (TIMSS-R). Ontario Report: Grade 8 Students*, Toronto, EQAO, 2000.

FERRER, C., and R. ALLARD. «La pédagogie de la conscientisation et de l'engagement : pour une éducation à la citoyenneté démocratique dans une perspective planétaire. Première partie : Portrait de la réalité sociale et importance d'une éducation à la conscientisation critique et à l'engagement», *Éducation et francophonie*, Vol. 30, No. 2, 2002a. On line at http://www.acelf.ca/revue/30-2/articles/04-ferrer-1.html.

FERRER, C., and R. ALLARD. «La pédagogie de la conscientisation et de l'engagement : pour une éducation à la citoyenneté démocratique dans une perspective planétaire. Deuxième partie : La PCE : concepts de base, transversalité des objectifs, catégorisation des contenus, caractéristiques pédagogiques, obstacles et limites», *Éducation et francophonie*, Vol. 30, No. 2, 2002b.
On line at http://www.acelf.ca/revue/30-2/articles/04-ferrer-2.html.

FRANCARD, M. «Les jeunes francophones et leur langue : de l'Acadie du Nouveau-Brunswick à la Wallonie,» *Revue de l'Université de Moncton*, Vol. 27, No. 1, pp. 147-160, 1994.

GÉRIN-LAJOIE, D., N. LABRIE, and D. WILSON. *Étude interprétative des résultats obtenus par les students franco-ontariens et franco-ontariennes en lecture et en écriture aux tests de niveaux provincial et national* (manuscript), Toronto, Centre de recherches en éducation franco-ontarienne (CREFO), 1995.

Groupe DIEPE. *Savoir écrire au secondaire : Étude comparative auprès de quatre populations francophones d'Europe et d'Amérique*, Brussels, De Boeck Université, 1995.

HAMERS, J. F. and M. H. A. BLANC. *Bilinguality and bilingualism*, Second edition, Cambridge, University Press, 2000.

HARRIS, K.R. and S. GRAHAM. *Making the writing process work: Strategies for composition and self-regulation*, Cambridge, MA, Brookline, 1996.

HÉBERT, R., M. BILODEAU, D. FOIDART, R. LÉGER, and C. SAINDON. *Performance académique et langue d'enseignement chez les students franco-manitobains*, Saint-Boniface, MB, Centre de recherches, Collège universitaire de Saint-Boniface, 1976.

HERRY, Y. «Enseignement et apprentissage des sciences : résultats de la troisième enquête internationale,» *Revue des sciences de l'éducation*, Vol. XXVI, No. 2, pp. 347-366, 2000.

HERRY, Y., R. LACASSE, and L. RADFORD. *TEIMS : La performance des éudiants francophones de l'Ontario*, 1998.

Kulik, C.-L. C., J. A. Kulik, and R. L. Bangert-Drowns. «Effectiveness of mastery learning programs: A meta-analysis,» *Review of Educational Research*, Vol. 60, pp. 265-299, 1990.

Landry, R. «Déterminisme et détermination : Vers une pédagogie de l'excellence en milieu minoritaire,» *La Revue canadienne des langues vivantes/The Canadian Modern Language Review*, Vol. 49, pp. 887-927, 1993.

Landry, R. «Le présent et l'avenir des nouvelles générations d'apprenants dans nos écoles françaises,» *Éducation et francophonie*, Vol. 22, pp. 13-23, 1995.

Landry, R. «Pour une pédagogie actualisante et communautarisante en milieu minoritaire francophone,» *Actes du colloque pancanadien sur la recherche en éducation en milieu francophone minoritaire : Bilan et prospectives*, 2002a. On line at http://www.acelf.ca/publi/crde/index.html.

Landry, R. «L'unité de l'apprenant et la pédagogie actualisante,» *Éducation et francophonie*, Vol. 30, No. 2, 2002b, (forthcoming).

Landry, R. «Pour une pleine réalisation du potentiel humain : la pédagogie actualisante,» *Éducation et francophonie*, Vol. 30, No. 2, 2002c (forthcoming).

Landry, R. and R. Allard. «Vitalité ethnolinguistique : une perspective dans l'étude de la francophonie canadienne,» *in* J. Erfurt, *De la polyphonie à la symphonie : méthodes, théories et faits de la recherche pluridisciplinaire sur le français au Canada*, Leipzig, Leipziger Universitätsverlag, pp. 61-88, 1996.

Landry, R. and R. Allard. «L'exogamie et le maintien de deux langues et de deux cultures: le rôle de la francité familioscolaire,» *Revue des sciences de l'éducation*, Vol. XXIII, pp. 561-592, 1997.

Landry, R. and R. Allard. «L'éducation dans la francophonie minoritaire,» in J. Y. Thériault, *Francophonies minoritaires au Canada : l'état des lieux*, Moncton, Les Éditions d'Acadie, pp. 403-434, 1999.

Landry, R. and R. Allard. «Langue de scolarisation et développement bilingue : le cas des acadiens et francophones de la Nouvelle-Écosse,» Canada, *DiversCité Langues*, Vol. V, 2000. On line at http://www.teluq.uquebec.ca/diverscite.

Landry, R., R. Allard and R. Bourhis. «Profils sociolangagiers des jeunes francophones et anglophones du Québec en fonction de la vitalité des communautés linguistiques,» *in* G. Budach and J. Erfurt, *Identité francocanadienne et société civile québécoise*, Leipzig, Leipziger Universtätsverlag, pp. 123-150, 1997.

Landry, R., R. Allard and D. Haché. «Ambiance familiale française et développement psycholangagier d'students franco-ontariens», in G. Duquette et P. Riopel, *L'éducation en milieu minoritaire et la formation des maîtres en Acadie et dans les communautés francophones du Canada*, Sudbury, ON, Laurentian University Press, pp. 41-103, 1998.

Landry, R. and J.-F. Richard. «La pédagogie de la maîtrise des apprentissages : une invitation au dépassement de soi,» *Éducation et francophonie*, Vol. 30, No. 2, 2002 (forthcoming).

Landry, R. and R. Rousselle. *Éducation et droit : pour le maintien et l'épanouissement de la francophonie canadienne*, Ottawa, Office of the Commissioner of Official Languages (forthcoming).

LAPLANTE, B. «Des students de sixième année apprennent à parler des réactions chimiques,» *in* D. Masny, *La culture de l'écrit : les défis de l'école et au foyer*, Montréal, Éditions Logiques, pp. 105-141, 2001.

MARTEL, A. *Droits, écoles et communautés en milieu minoritaire : 1986-2002. Analyse pour un aménagement du français par l'éducation*, Ottawa, Office of the Commissioner of Official Languages, pp. 10, 2001.

NADEAU, M. *Recueil des pratiques réussies en français de la 1re à la 5e année*, Ottawa, Centre franco-ontarien de ressources pédagogiques (CFORP), 2002.

PRUNEAU, D. and J. LANGIS. «L'enseignement et l'apprentissage des sciences en milieu minoritaire : défis et possibilités,» *Actes du colloque pancanadien sur la recherche en éducation en milieu francophone minoritaire : Bilan et prospectives,* 2002. On line at http://www.acelf.ca/publi/crde/index.html.

PRUNEAU, D. and C. LAPOINTE. «Un, deux, trois, nous irons aux bois. L'apprentissage expérientiel et ses applications en éducation relative à l'environnement,» *Éducation et francophonie*, Vol. 30, No. 2, 2002 (forthcoming).

ROUSSELLE, A. *De la théorie à la pratique : la maîtrise des apprentissages au Nouveau-Brunswick francophone*, unpublished masters thesis, Université de Moncton, 2003.

SIMON, M., and M.-J BERGER. *Liens entre les attitudes, le sexe et le rendement aux tests provinciaux des students de 3e année et de 6e année dans les écoles de langue française de l'Ontario*, EQAO Research Series, No. 4, Toronto, Education Quality and Accountability Office (EQAO), 1999.

TAYLOR, B. M., M. PRESSLEY, and D. PEARSON. *Effective teachers and schools: Trends across recent studies.* Michigan, 2000. (ERIC Document Reproduction Service No. ED 450 353)

VALLERAND, R. J. «La motivation intrinsèque et extrinsèque en contexte naturel : implications pour les secteurs de l'éducation, du travail, des relations interpersonnelles et des loisirs,» in R. J. Vallerand and E. E. Thill, *Introduction à la psychologie de la motivation*, Laval, QC, Éditions Études Vivantes, pp. 534-581, 1993.

VIAU, R. *La motivation dans l'apprentissage scolaire*, Saint-Laurent, Quebec, Éditions du Renouveau Pédagogique, 1994.

WANG, M. C., G. D. HAERTEL, and H. J. WALBERT. «What influences learning? A content analysis of review literature,» *Journal of Educational Research*, Vol. 84, No. 1, pp. 30-43, 1990.

WANG, M. C., G. D. HAERTEL, and H. J. WALBERT. «Toward a knowledge base for school learning,» *Review of Educational Research*, Vol. 63, No. 3, pp. 249-294, 1993.

WANG, M. C., G. D. HAERTEL, and H. J. WALBERT. «What helps students learn?» *Educational Leadership*, December 1993–January 1994, pp. 74-79, 1994.