Introduction

The value of student achievement information is greatly enhanced by linking it, as much as possible, to the context within which students live and learn. Social, educational, and personal environment all contribute to student learning and therefore to the performance on such assessments as those administered by SAIP.

Prior to the SAIP Science II Assessment (1999), such context data had been collected through questionnaires administered to the sampled students. Data so collected was then reported only briefly in the public report, and in more detail in the technical report.

For subsequent assessments, including the Mathematics III Assessment, additional context information was collected through questionnaires completed by subject teachers and by school administrators describing the school environment. While maintaining a commitment to the anonymity of individual students, teachers, and schools, researchers can use this information to examine the complex linkages between student achievement and its context, as described by students, their teachers, and the schools in which they work.

The following pages highlight *some* of the results of the questionnaires that were administered in the current assessment. Much more complete information, including jurisdictional results, will appear in *Mathematics Learning: The Canadian Context* and in the technical report. The data apply to Canada as a whole, but not necessarily to any individual jurisdiction. All figures represent percentages unless otherwise indicated. Percentages may be rounded.

Each student who participated in the Mathematics III Assessment was asked to complete a questionnaire about mathematics practices and attitudes.

The sample responses from students that follow are cross-tabulated with student achievement results. *Student responses are tabulated against the percentage of each age group that met the expected criteria for that age group, that is, level 2 for 13-year-old students and level 3 for 16-year-old students.*

It is important to note that these are simply examples of the much more detailed reporting and analysis that will be found in *Mathematics Learning: The Canadian Context* and in the technical report.

Table S-1

MATHEMATICS IN FUTURE ENDEAVOURS

Do you expect to eventually work in a field that requires further education in mathematics?

AGE		*Yes*
13-year-olds	% of students achieving below criterion*	38%
	% of students achieving at or above criterion**	51%
16-year-olds	% of students achieving below criterion[#]	33%
	% of students achieving at or above criterion[##]	53%

* That is, 38% of 13-year-old students who failed to reach level 2 expect to eventually work in a field that requires further education in mathematics.

** That is, 51% of 13-year-old students who achieved level 2 or above expect to eventually work in a field that requires further education in mathematics.

[#] That is, 33% of 16-year-old students who failed to reach level 3 expect to eventually work in a field that requires further education in mathematics.

[##] That is, 53% of 16-year-old students who achieved level 3 or above expect to eventually work in a field that requires further education in mathematics.

The results reported in Table S-1 suggest that students who are more successful in mathematics are more likely to aspire to work in a field that requires this particular talent.

Table S-2

In a normal week (including the weekend), how much time do you usually spend taking other lessons (e.g., music, swimming) outside of school hours?

AGE		*One hour or more per week*
13-year-olds	% of students achieving below criterion	47%
	% of students achieving at or above criterion	55%
16-year-olds	% of students achieving below criterion	34%
	% of students achieving at or above criterion	43%

Table S-2 suggests that more successful mathematics students spend more time participating in extracurricular learning activities.

Table S-3

In a normal week (including the weekend), how much time do you usually spend studying or doing homework in mathematics outside of school hours?

AGE		*One hour or more per week*
13-year-olds	% of students achieving below criterion	48%
	% of students achieving at or above criterion	57%
16-year-olds	% of students achieving below criterion	47%
	% of students achieving at or above criterion	63%

Table S-3 suggests that more successful mathematics students, particularly in more senior courses, spend more time working on mathematics outside of school hours.

Table S-4

In a normal week (including the weekend), how much time do you usually spend studying or doing homework in other subjects outside of school hours?

AGE		*One hour or more per week*
13-year-olds	% of students achieving below criterion	59%
	% of students achieving at or above criterion	72%
16-year-olds	% of students achieving below criterion	69%
	% of students achieving at or above criterion	82%

The information in Table S-4 suggests that older students generally spend more time studying and doing homework, and that more successful mathematics students spend more time than do less successful students.

Table S-5

In a normal week (including the weekend), how much time do you usually spend reading for enjoyment outside of school hours?

AGE		*One hour or more per week*
13-year-olds	% of students achieving below criterion	35%
	% of students achieving at or above criterion	48%
16-year-olds	% of students achieving below criterion	39%
	% of students achieving at or above criterion	49%

Table S-5 illustrates the positive relationship between reading for enjoyment and mathematics achievement.

Table S-6

How often do you and your parent(s) or guardian(s) work together on your mathematics homework?

AGE		*"Almost every day" to "a few times a week"*
13-year-olds	% of students achieving below criterion	28%
	% of students achieving at or above criterion	16%
16-year-olds	% of students achieving below criterion	10%
	% of students achieving at or above criterion	5%

Table S-6 shows that less successful mathematics students seem to work more often with parents and guardians, perhaps in an effort to increase their success rate.

Table S-7

How often is the Internet used in your mathematics courses this year?

AGE		*"Almost every day" to "a few times a week"*
13-year-olds	% of students achieving below criterion	15%
	% of students achieving at or above criterion	7%
16-year-olds	% of students achieving below criterion	8%
	% of students achieving at or above criterion	4%

Table S-7 shows that the Internet is rarely used in mathematics courses, but perhaps students with difficulties are encouraged to search there for additional resources.

Table S-8

Do you have these things in your home? - computer

AGE		*Yes*
13-year-olds	% of students achieving below criterion	88%
	% of students achieving at or above criterion	93%
16-year-olds	% of students achieving below criterion	89%
	% of students achieving at or above criterion	96%

Overall data for this question show that 92.8 % of all students who responded report having a computer at home. Table S-8 shows that home computers are slightly more common in the homes of students who met the SAIP Mathematics criteria.

Table S-9

Do you have these things in your home? - Internet connection

AGE		*Yes*
13-year-olds	% of students achieving below criterion	74%
	% of students achieving at or above criterion	85%
16-year-olds	% of students achieving below criterion	78%
	% of students achieving at or above criterion	88%

Overall data for this question show that 83.2% of all students who responded report having an Internet connection at home. Table S-9 shows that Internet connections are slightly more common in the homes of students who met the SAIP Mathematics criteria.

Introduction

Approximately 5,400 responses were received to this questionnaire, which was addressed to teachers of the students who were selected to write the SAIP Mathematics III Assessment. The information collected deals with the work of the teachers and their approach to mathematics teaching.

As with the other questionnaire data, complete findings will be available in *Mathematics Learning: The Canadian Context* and in the technical report.

Selected Data

The information below was selected for inclusion in the public report to provide some indication of the types of questions asked and a range of the responses to them.

Note: The median is the value of the middle element of a set of responses, the element that equal numbers of responses are below and above.

For example, when asked how many hours per week they were scheduled to teach mathematics classes, teachers indicated that the median was 5.5 hours; in other words, half of the teachers responding reported 5.5 hours or fewer, and half reported 5.5 hours or more.

Table T-1

CLASS SIZE

What is the AVERAGE number of students in the mathematics classes you teach this year?

Median size is 24 students; 94% of teachers reported an average of 31 or fewer students.

LARGEST class size

Median size is 27 students; 10% of teachers reported a largest class of more than 33 students.

SMALLEST class size

Median size is 19 students; 80% of teachers reported a smallest class of 25 or fewer students.

Most classes appear to have between 25 and 33 students, although a few teachers reported classes as small as 8 students and as large as 40 students.

WORK OUTSIDE OF SCHOOL HOURS

Table T-2

How many hours per week do you spend on PLANNING AND PREPARATION outside of formal school hours?

	%
No time	0.2
Less than 1 hr.	1.8
1–2 hrs.	17.7
3–4 hrs.	28.2
5–6 hrs.	21.2
More than 6 hrs.	30.8

Table T-3

How many hours per week do you spend on MARKING STUDENT WORK outside of formal school hours?

	%
No time	0.2
Less than 1 hr.	2.7
1–2 hrs.	26.5
3–4 hrs.	37.0
5–6 hrs.	17.6
More than 6 hrs.	15.9

Table T-4

How many hours per week do you spend on ADMINISTRATIVE DUTIES outside of formal school hours?

	%
No time	23.6
Less than 1 hr.	33.5
1–2 hrs.	29.5
3–4 hrs.	7.7
5–6 hrs.	2.1
More than 6 hrs.	3.6

Teachers report spending a significant part of their out-of-school time planning and preparing lessons and marking student work. More than 80% of the teachers reported spending 3 hours or more per week planning lessons, and more than 70% spend 3 hours or more per week marking.

Table T-5

CLASSROOM STRATEGIES

How often do the following things happen in your mathematics classes?

The following figures represent the percentages of teachers who reported either "a few times a week" or "almost every class" on a four-point scale for selected categories.

I give overviews.	56%
I model how to solve problems for students.	92%
I teach a variety of problem-solving strategies.	66%
Students work in pairs or small groups.	57%
Students work on assigned exercises from the textbook.	91%
I give feedback to the class on assignments, tests, or other evaluations.	62%
I attempt to diagnose and address individual student problems or needs in learning.	71%
Students use workbooks or worksheets.	59%
I read from or summarize the textbook.	40%
I work with students individually.	90%
We discuss or do things other than the topic of the lesson.	34%

This table shows that teachers use a wide variety of teaching strategies in the classroom. Most frequently reported are modelling how to solve problems and having students work on assigned exercises. Perhaps this allows more classroom time for the other most common strategy — working with individual students.

Table T-6

ASSESSMENT STRATEGIES

The following figures represent the percentages of teachers who reported either "quite a lot" or "a great deal" on a four-point scale for selected categories.

In assessing the work of students in your mathematics courses, how much weight do you give each of the following?

Standardized tests produced outside the school	16%
Teacher-made short answer or essay tests that require students to explain their reasoning	53%
Teacher-made multiple-choice, true-false, or matching tests	24%
Homework assignments	43%
Projects	15%
Portfolios of student work	11%
Observations of or interviews with students	17%
Attendance in class	21%
Participation of students in class activities	28%
Effort	37%
Improvement over the year or term	34%
Student self-assessment	9%
Peer evaluation	3%
Independent study projects	7%
Other	20%

Again, as one would expect, this table shows that teachers use a great variety of assessment strategies.

Some particularly interesting data:

- *About 16% of teachers give weight to external standardized tests when assessing students.*
- *About 34% give weight to improvement over year or term.*
- *About 17% give weight to observations or interviews with students.*
- *About 7% give weight to independent study projects.*

Table T-7

TEACHER QUALIFICATIONS

Which of the following degrees or diplomas do you hold?

(Teachers were asked to check all that apply.)

B.A., B.Sc., or equivalent in mathematics	32.0%
B.Sc. or equivalent in a subject other than mathematics	22.0%
B.A. or equivalent in a subject other than mathematics	23.0%
Other degree with substantial mathematics content (e.g., engineering or computer science)	7.4%
B.Ed. or equivalent (e.g., at least one year of teacher training)	82.0%
Special Education diploma/certificate	5.5%
Special Education degree	1.5%
Trade or technical diploma or equivalent	3.2%
Master's degree in education	11.0%
Master's degree in another subject	4.8%
Ph.D. or equivalent	0.8%
Other degree or diploma	13.0%
No degree or diploma	0.4%

This table contains some interesting data. Less than 40% of teachers hold a mathematics degree or one with substantial mathematics content. Almost 20% have less than one year of teacher training. Less than 10% hold special education qualifications.

Introduction

Approximately 1,700 responses were received to this questionnaire, which was addressed to the school principal. The information collected deals with the nature of the community, the school itself, and the resources available.

As with the other questionnaire data, detailed information will be available in *Mathematics Learning: The Canadian Context, 2001* and in the technical report.

Selected Data

The information below was selected for inclusion in the public report to provide some indication of the types of questions asked and a range of the responses to them.

Table P-1

Approximately what percentage of students in your school would you estimate have a first language other than the language of the school?

Percentage of students with a first language other than the language of the school	*Percentage of schools with the given percentage of students*		
	Language of the school		
	English	*French*	*Total*
Less than 10%	79.8%	65.8%	77.0%
10–25%	10.3%	12.0%	10.6%
More than 25%	10.0%	22.2%	12.4%

Table P-2

What percentage of students have learning problems that need special attention?

Students with learning problems	*% of schools with the given percentage of students*
Less than 10%	46.2
10–25%	46.0
More than 25%	7.8

Table P-3

What percentage of students come from single-parent families?

Students from single-parent families	*% of schools with the given percentage of students*
Less than 10%	31.1
10–25%	50.8
More than 25%	18.1

Table P-4

What percentage of students have health or nutrition problems that inhibit learning?

Students with health or nutrition problems	*% of schools with the given percentage of students*
Less than 10%	77.5
10–25%	17.5
More than 25%	5.0

Nearly one-quarter of the schools reported more than 10% of their students having a first language other than that of the school. More than one-half of the schools reported that more than 10% of their students need special attention. Nearly 70% of the schools reported that more than 10% of their students come from single-parent families, and nearly one-quarter of the schools reported that more than 10% of their students have health or nutrition problems.

Table P-5

Principals were asked to what degree the school's capacity to provide instruction is limited by the following:

The following figures represent the percentages of principals who reported either "some" or "a lot" on a four-point scale for *selected* categories.

a)	Lack of parental support for the school	28%
b)	Range of student abilities in the school	56%
c)	Students' home background	48%
d)	Community conditions (e.g., language, migration)	28%
e)	Bussing of students	22%

Table P-6

Principals were asked to what degree the school's capacity to provide instruction is limited by shortage or inadequacy of the following:

The following figures represent the percentages of principals who reported either "some" or "a lot" on a four-point scale for *selected* categories.

a)	Teachers specialized in mathematics	30%
b)	Instructional materials (e.g., textbooks)	30%
c)	Numbers of computers for mathematics teaching	47%
d)	Calculators for mathematics teaching	24%
e)	Manipulative materials for mathematics teaching	25%
f)	Library resources for mathematics teaching	29%

The importance of close relations between schools and their communities and the need for resources of all types are highlighted in the above tables. Again, complete findings will be available in Mathematics Learning: The Canadian Context *and in the technical report.*

Table P-7

Principals were asked to what extent they agree with a series of statements.

The following percentages represent those principals who "agreed" or "agreed strongly" on a four-point scale.

• There are limits to what a school can accomplish because a student's home environment has a large influence on achievement.	76%
• Students can achieve high levels if they work hard.	94%
• High school students should be streamed into different programs based on their abilities and aptitudes.	84%
• Students can achieve high levels if they are taught well.	93%
• Student ability has a large influence on achievement.	93%
• This school is supported by the community.	90%
• Staff morale is high in this school.	89%
• There is a strong school spirit in this school.	87%
• Students and staff take pride in this school.	96%

A majority of principals appear confident that they are providing supportive learning environments for their students, at least in terms of the issues addressed in this table.

Table P-8

What is the approximate average class size in your mathematics classes for 13-year-olds?

	% of schools
Less than 10	5.5
10–14	7.0
15–19	12.5
20–24	25.8
25–29	35.4
30–33	12.8
34 or more	1.1

Table P-9

What is the approximate average class size in your mathematics classes for 16-year-olds?

	% of schools
Less than 10	6.0
10-14	10.0
15-19	14.6
20-24	26.7
25-29	32.4
30-33	9.4
34 or more	0.9

Half of the principals report class sizes for 13-year-old students of 24 or fewer. Nearly 60% report classes of 24 or fewer for 16-year-old students.

This report describes the performance of 41,000 English- and French-speaking 13- and 16-year-old Canadian students in the SAIP Mathematics III Assessment (2001). For some jurisdictions, the sample included a number of students for whom neither English nor French is spoken at home. This pan-Canadian mathematics assessment is the first of the three SAIP subject assessments to be administered for the third time using essentially the same process, but following an extensive review of the framework and criteria and of the instruments themselves.

The assessment instruments were designed, developed, and reviewed by representatives of the ten provinces and the three territories, working together under the leadership of the development team. This assessment was also made possible by the cooperation extended to the development teams by students, teachers, parents, and stakeholder representatives.

In spite of the diversity of student circumstances and education experiences across the country, this challenging exercise nevertheless produced a comprehensive assessment of important mathematical knowledge and skills.

In both the assessment of mathematics content and the assessment of problem solving, roughly two-thirds of 13-year-old students reached level 2, and nearly half of 16-year-old students reached level 3.

Given that 13-year-olds and 16-year-olds are administered the same assessment, the SAIP designers thought that the largest proportion of the younger group would achieve level 2 and that the largest proportion of the older group would achieve level 3. A sizeable percentage of 13-year-old students reached level 3 and above and more than 10% of 16-year-old students acheived at levels 4 and 5 in each component. This performance represents a high level of mathematics knowledge and skills for students in each age group.

Both in mathematics content and in problem solving, the highest level achieved by many students was level 3, the middle of a five-level scale. To be assigned level 3 in mathematics content, a student had to show that he or she could, for example,

- use the four basic operations with natural numbers and integers
- use concrete materials and diagrams to represent relations
- use monomial algebraic expressions and plot points on a Cartesian grid
- use length, angle measure, area, volume, and repetitions of the same geometric transformation
- extract and represent data using tables and diagrams
- use information from various sources and calculate arithmetic mean and simple probabilities

To be assigned level 3 in problem solving, a student had to show that he or she could

- use more than one particular case to establish a proof
- choose from two algorithms to find solutions to multi-step problems, using a limited range of rational numbers
- use necessary and sufficient cases to establish a proof
- use mathematical vocabulary imprecisely to present solutions

Although these definitions may seem technical, they were developed by mathematics and curriculum specialists in order to set out specifically the concepts underlying the design of the tests and the evaluation of the results.

Changes are varied in student performance for mathematics content between 1997 and 2001. In 2001, fewer 13-year-old students achieved level 1, but more 13-year-old students performed at level 2. More 16-year-old students achieved level 2 than in 1997, but fewer 16-year-olds reached levels 1 and 3. Results for problem solving in 2001 showed considerable improvement since 1997. In both age groups, more students achieved levels 2, 3, 4, and 5 than in 1997. This change was particularly marked for 13-year-old students. Quebec 16-year-old students did not participate in the 2001 assessment.

There were small but seemingly unsystematic differences in the achievement levels of males and females in both the mathematics content assessment and the problem solving assessment.

Some differences in performance can be observed between students who responded to the assessment in French and those who responded in English. Since Quebec 16-year-old students did not participate in the 2001 assessment, it is difficult to reach any generalizable conclusions.

In 2001, a pan-Canadian panel of representatives of various sectors of society developed a set of expectations to help interpret the results actually achieved by the students. The expectations of the panellists for student performance were consistently higher than that actually achieved by Canadian students. Expectations were more closely met at higher performance levels than at lower performance levels.

In this assessment again, 16-year-olds performed much better than 13-year-olds. Although this finding will come as no surprise, this process makes it possible to measure and document with reliable statistics the achievement gap in mathematics between those age groups across Canada. We can at least infer that our educational systems do foster the development of mathematics knowledge and skills between the ages of 13 and 16.

Comparisons between the mathematics content and the problem solving component results should only be attempted with caution. While students may appear to have achieved higher or lower scores in problem solving than in mathematics content, this may not be significant since different criteria were used in the two assessments, and it is impossible to equate the degree of difficulty of the questions contained in each component.

Results from, and expectations established for, the 2001 assessment will serve as points of comparison for the next mathematics assessment.