RESULTS OF THE 2001 MATHEMATICS ASSESSMENT

This report provides results on Canada as a whole, as well as those of individual jurisdictions. To facilitate understanding of the many graphs and charts that follow, this section begins with a short note on interpreting the results.

NOTES ON STATISTICAL INFORMATION

In this report, most performance-by-level charts are based on **cumulative results** and actually show percentages of students **at or above** each level. The implication here is that students performing, for example, at level 5 have also satisfied the criteria for levels 1, 2, 3, and 4.

Differences

In this report the terms "difference" or "different," used in the context of performance levels and percentages, refer to a difference that is not due to chance. In a technical sense, they refer to a **statistically significant differenc**e. A difference is statistically different when there is no overlap of confidence intervals between the two measurements.

Confidence Intervals

In this study, the percentages calculated by the researchers were based on samples of students and are only estimates of the actual achievement students would have demonstrated had all students in the population taken the assessment. Because an estimate based on a sample is rarely exact, it is common practice to provide a range of percentages within which the actual achievement level might fall. This range of percentage values is called a confidence interval and represents the high- and low-end points between which the actual achievement level should fall 95% of the time. In other words, one can be confident that the actual achievement level of all students would fall somewhere into the established range 19 times out of 20, if the assessment were repeated with different samples of the same student population.

In the charts in this report, confidence intervals are represented by the following symbol: ├─┤. If the confidence intervals overlap, the differences are not statistically significant. It should be noted that the size of the confidence interval depends upon the size of the sample. In jurisdictions with a smaller sample, a large interval may indicate difficulties in estimating the actual achievement of the population and does not necessarily reflect on the competency of the students who were administered the assessment.

Box 5

Statistical Comparisons

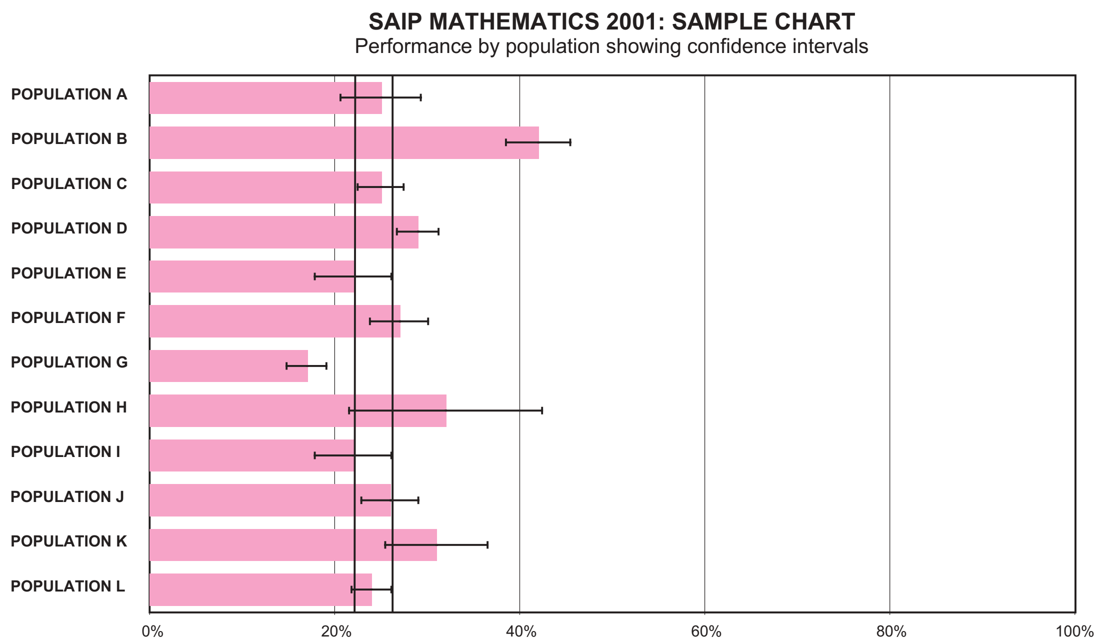
The performance of students in Canada (and within each jurisdiction) was compared by looking at the average scores for all students in each jurisdiction and at the distribution of these scores.

Because the available scores were based on samples of students from each jurisdiction, we cannot say with certainty that these scores are the same as those that would have been obtained had all 13-year-old and 16-year-old students been tested. We use a statistic called the *standard error* to express the degree of uncertainty in the scores for the sample compared with the population. Using the standard error, we can construct a confidence interval, which is a range of scores within which we can say, with a known probability (such as 95%), that the score for the full population is likely to fall. The 95% confidence interval used in this report represents a range of plus or minus about two standard errors around the average.

The following charts are intended as representations of numerical data, and as such cannot always be interpreted with the same degree of precision as the actual numbers. This is particularly true for small percentages and small confidence intervals. For more precise data, please refer to the numerical tables in the appendix to this report, and to the forthcoming technical report.

SAMPLE CHART

The following chart is provided to help readers interpret the confidence intervals used in this report. For example, there is no significant difference between population L and populations A, C, E, F, H, I, J, and K, but there are significant differences between population L and populations B, D, and G because their confidence intervals do not overlap.



Introduction

In this section of the report, results are presented for Canada as a whole. The following charts are included:

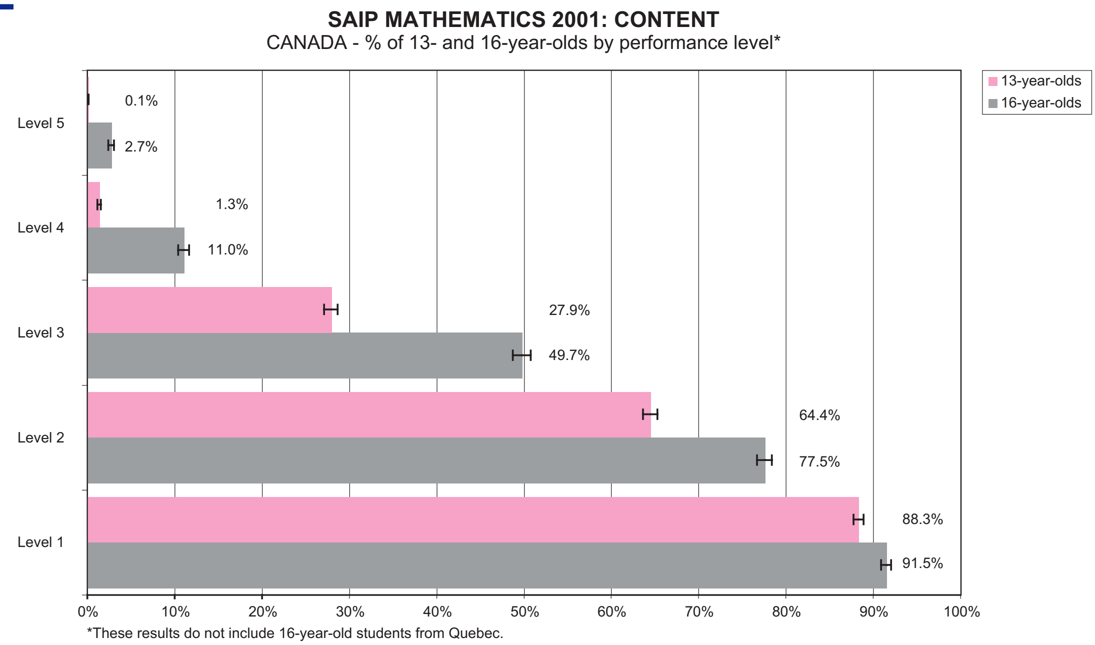
- Chart C1 – Mathematics Content by Age
- Chart C2 – Problem Solving by Age
- Charts C3 through C6 – Comparison of 1997 and 2001 Results
- Charts C7 through C10 – Achievement Differences by Gender
- Charts C11 through C14 – Achievement Differences by Language
- Charts C15 through C18 –Pan-Canadian Expectations

Overall Results

Since both groups were given the same assessment items, one would expect that there would be significant differences between the performances of 13-year-old and 16-year-old students at each of the five levels in both mathematics content and problem solving.

As the following charts (charts C1 and C2) indicate, the results for the 2001 assessment support this expectation. In addition, as one might expect, there are more older students at higher levels (4 and 5) and fewer at lower levels. While the overall results are not surprising with this data, what once would have been only an expectation can now be stated with some certainty.

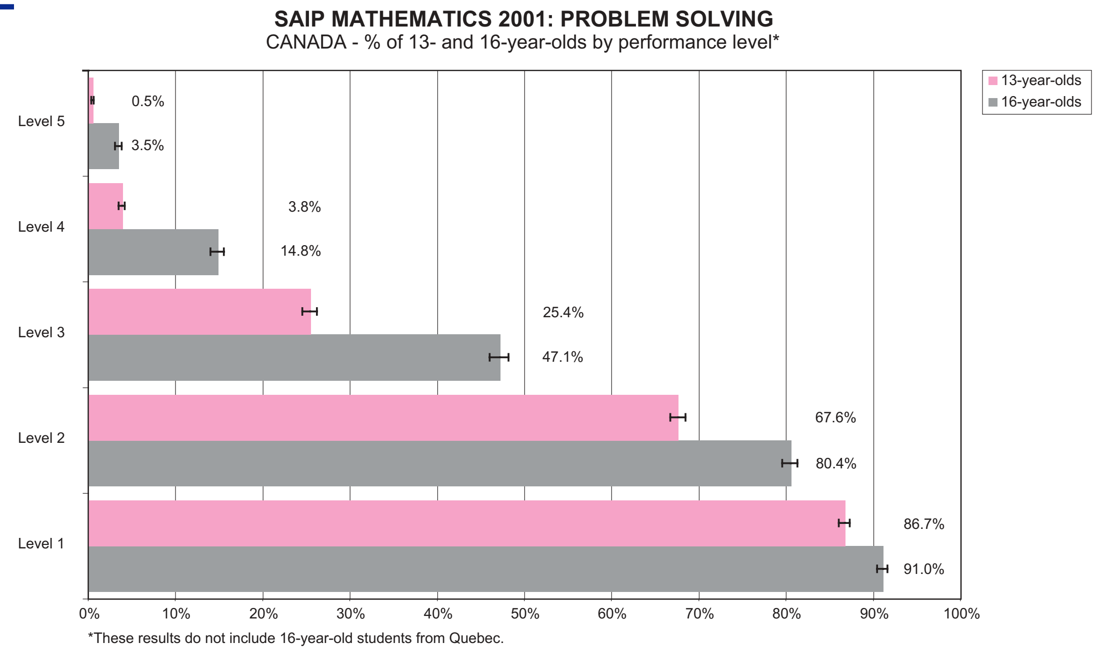
CHART C1



In the content assessment, nearly two-thirds of the 13-year-olds achieved level 2, where they demonstrated competence in such areas as using the four basic operations with natural numbers, using patterns and classifications in real-life situations, and extracting and representing data using tables and diagrams.

Half of the 16-year-olds achieved level 3, where they demonstrated competence in such areas as using the four basic operations with integers; using monomial algebraic expressions and plotting points on a Cartesian grid; using length, angle measure, and area involving various plane geometric figures; and using information from various sources to calculate the arithmetic mean and simple probabilities.

CHART C2



In the problem solving assessment, more than two-thirds of 13-year-olds achieved level 2 where they demonstrated such abilities as making a choice of algorithms to find a solution to multi-step problems using a limited range of whole numbers or to one-step problems using rational numbers; using more than one particular case to establish a proof; and using common vocabulary to present solutions.

Nearly half of the 16-year-olds reached level 3 where they demonstrated such abilities as choosing from two algorithms to find a solution to multi-step problems using a limited range of rational numbers; using necessary and sufficient cases to establish proof; and using mathematical vocabulary, imprecisely, to present solutions.

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.

ACHIEVEMENT DIFFERENCES 1993, 1997, AND 2001

While considerable effort was made to ensure statistical comparisons could be made among all three assessments, significant changes in scoring methods and assessment design since 1993 make such a comparison possible only between the 1997 and 2001 assessments. In 2001 there were some small changes made in the distribution of question types among levels and strands to ensure an equal distribution of items. Accommodations also had to be made to increase the number of questions related to data management and probability, reflecting current curriculum trends. Nevertheless, it was found to be statistically sound to make direct comparisons between the 1997 results and 2001 results.

Charts C3 through C6 summarize the changes in student performance in mathematics content and problem solving for both age groups.

One factor that must be kept in mind in making such comparisons for 16-year-old students is the absence of Quebec 16-year-olds in the 2001 assessment.

CHART C3

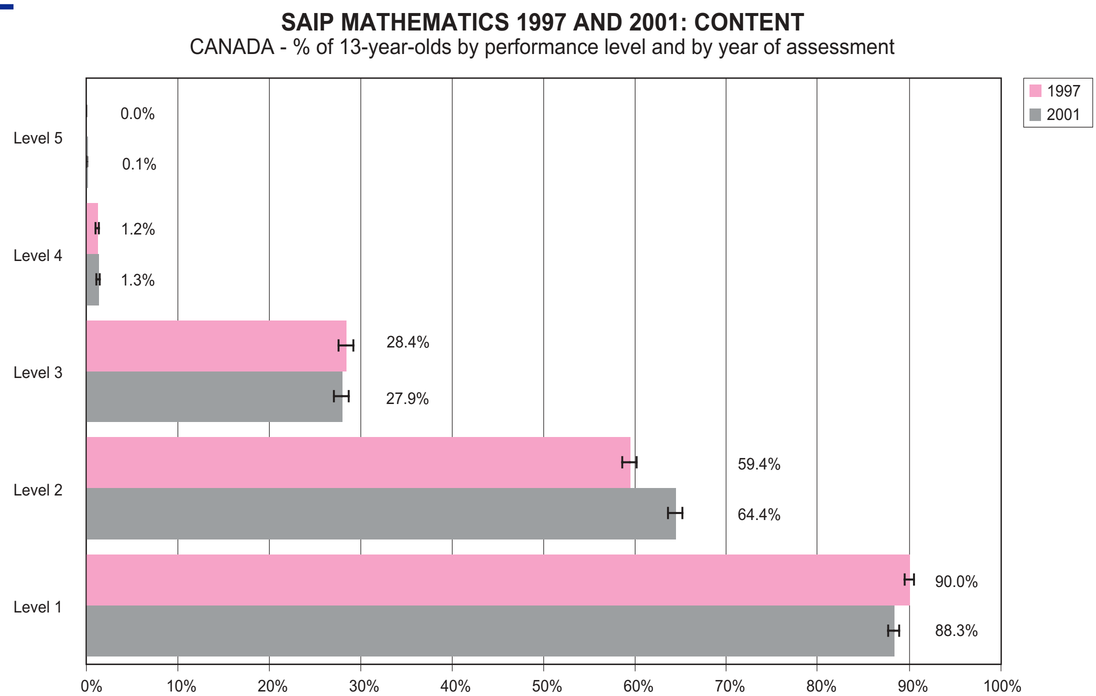
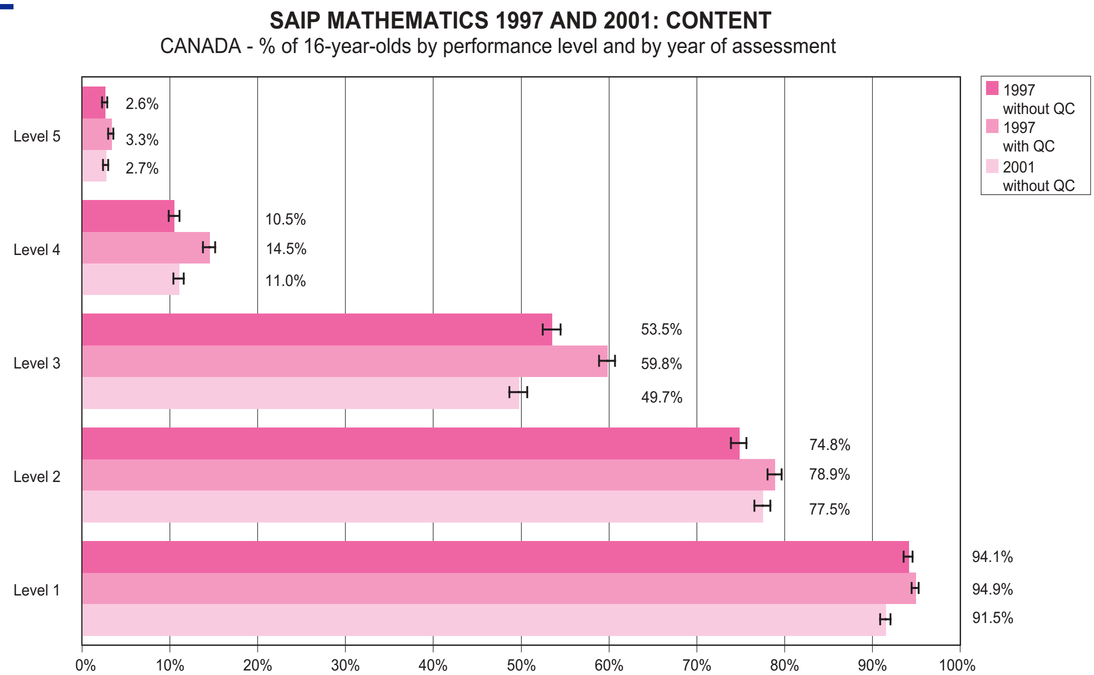


CHART C4



For the content component of the mathematics assessment, significantly more 13-year-old students achieved level 2 in 2001 than in 1997, the year in which the last SAIP Mathematics Assessment was administered. Quebec 16-year-old students did not participate in the SAIP 2001 Mathematics Assessment. In the content component, fewer 16-year-old students achieved levels 1 and 3 in 2001 than in 1997. However, the percentage of 16-year-olds achieving levels 4 and 5 is the same for 1997 and 2001.

CHART C5

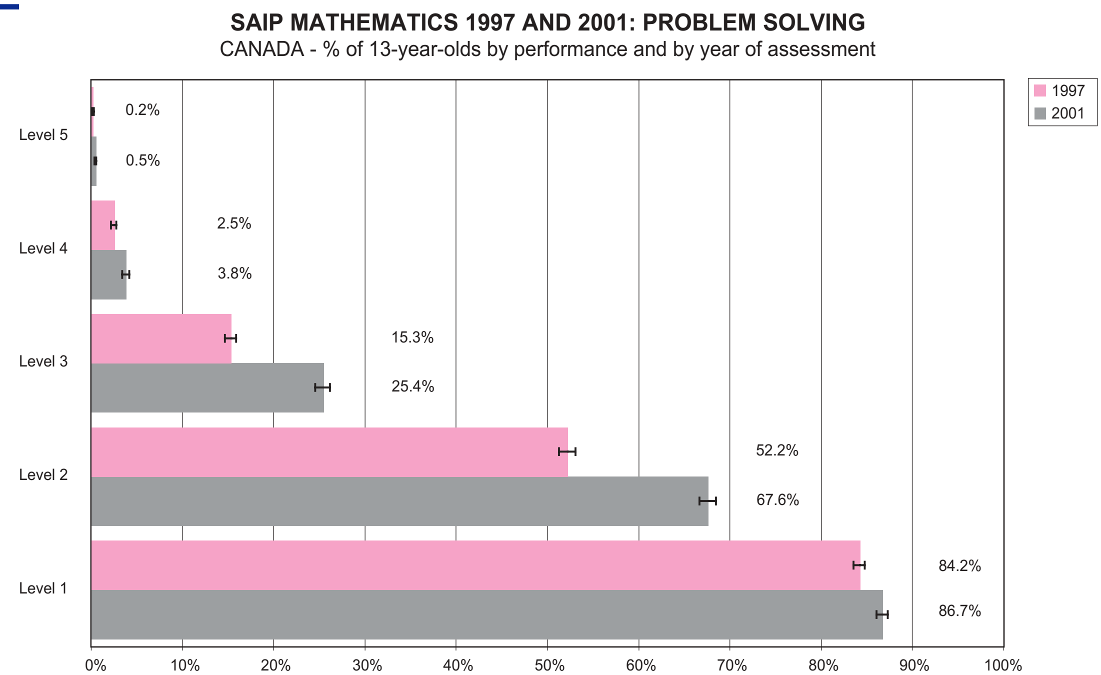
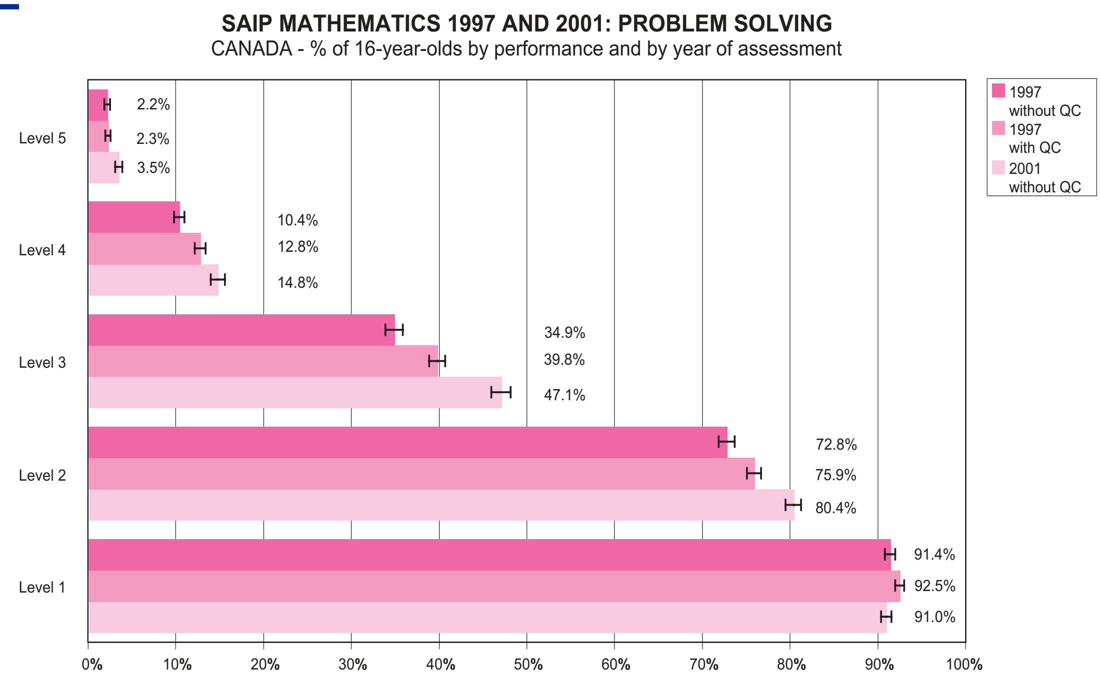


CHART C6



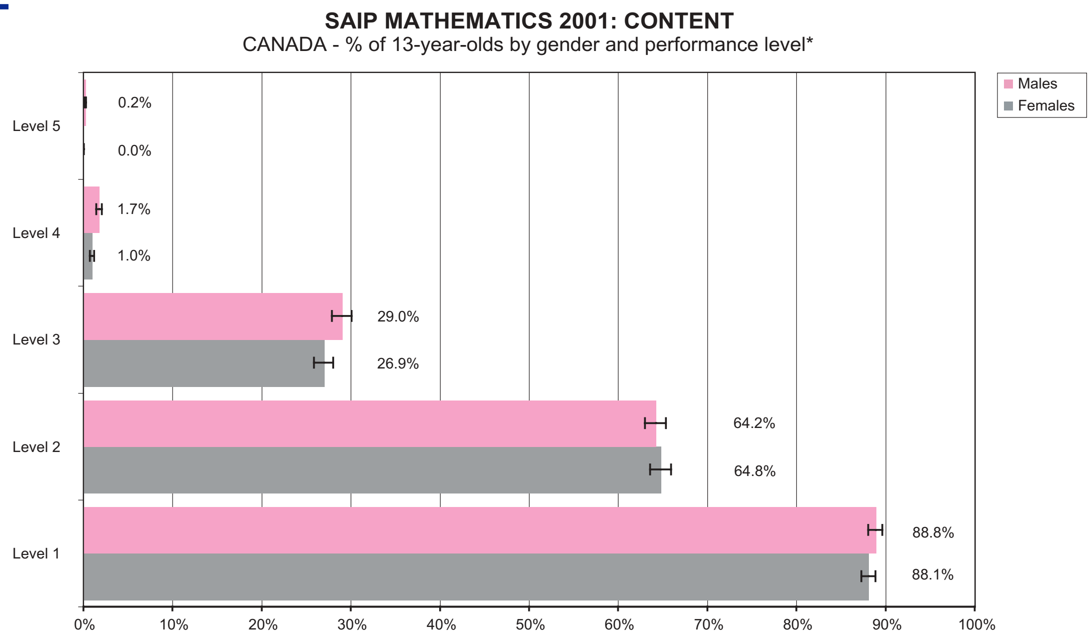
Significant increases in the percentages of 13-year-olds and 16-year-olds achieving levels 2, 3, 4, and 5 in the problem solving component are evident from 1997 to 2001. Quebec 16-year-old students did not participate in the SAIP 2001 Mathematics Assessment.

Preliminary analysis of the 1997 and 2001 results has also shown that the improvement in these results has been due to improved student performance, rather than to any changes in the difficulty of the questions or to the scoring process. Detailed discussion of this will be found in the technical report to be released later.

ACHIEVEMENT DIFFERENCES BY GENDER

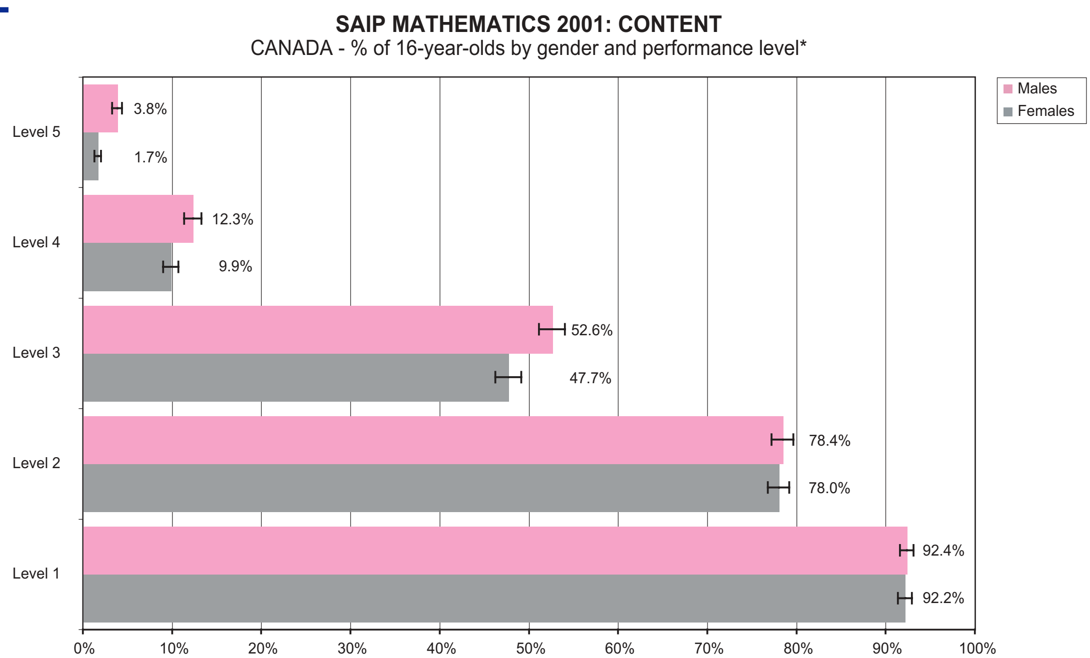
There has long been an interest in examining differences in achievement between boys and girls in a variety of subject areas — and at a variety of ages. The following four charts represent the results separated by gender for Mathematics III.

CHART C7



*These results do not include 13-year-old students for whom gender was not available.

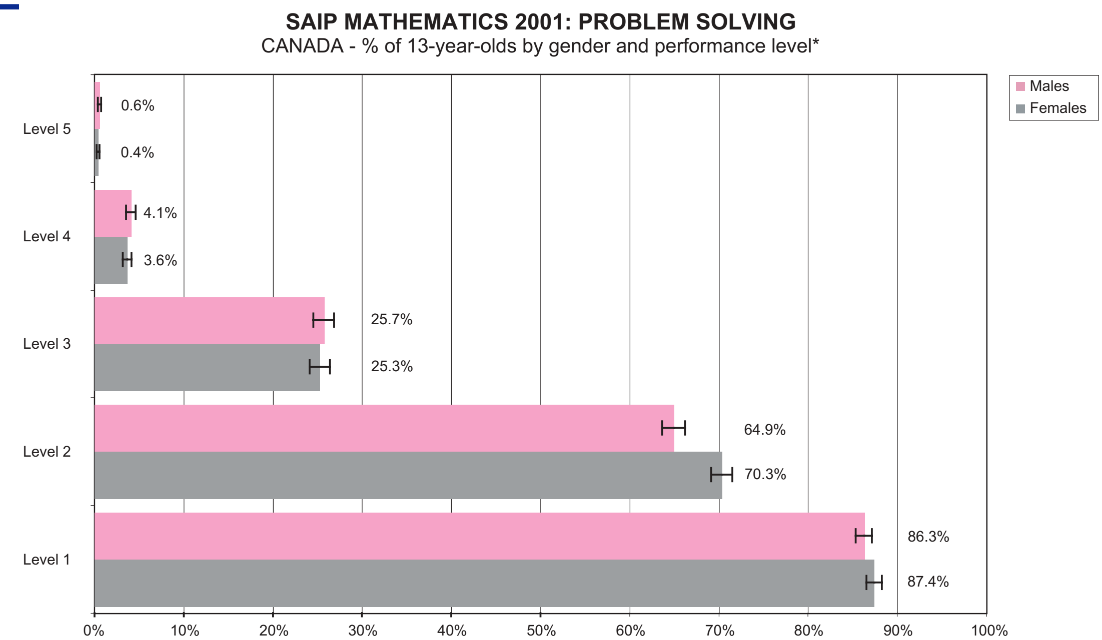
CHART C8



*These results do not include 16-year-old students from Quebec or students for whom gender was not available.

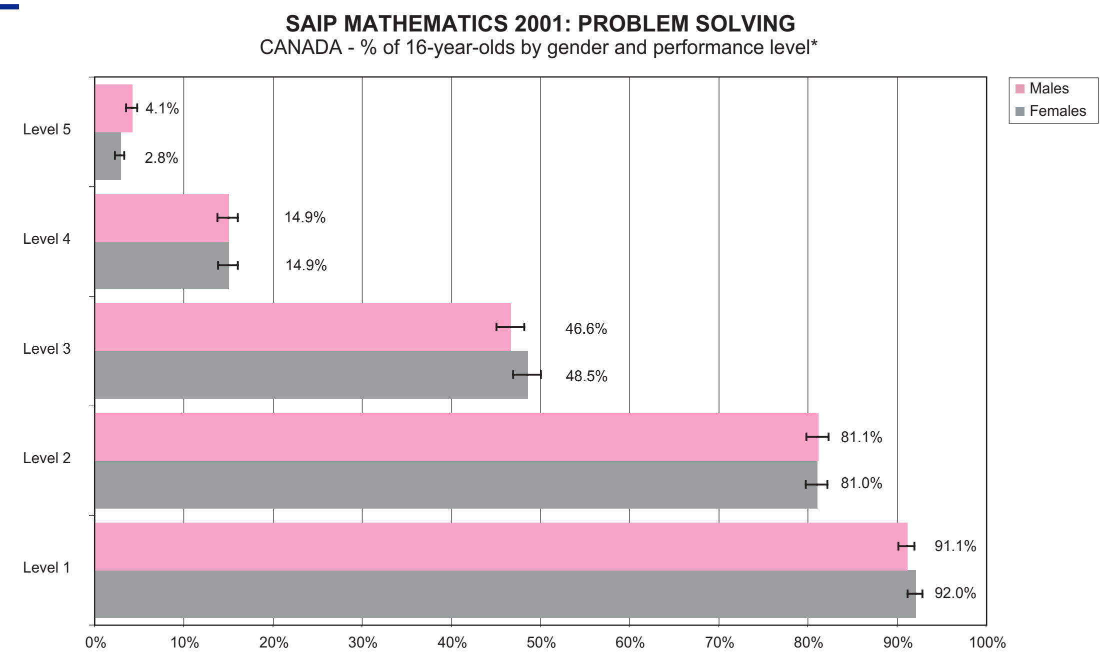
The results in charts C7 and C8 show that slight differences exist in achievement between boys and girls at several levels in mathematics content. For 13-year-old students, slightly more boys than girls achieved levels 4 and 5. For 16-year-old students, slightly more boys than girls achieved levels 3, 4, and 5.

CHART C9



*These results do not include 13-year-old students for whom gender was not available.

CHART C10



*These results do not include 16-year-old students from Quebec or students for whom gender was not available.

For the problem solving component, there was little difference in performance between male and female students. For 13-year-old students, more girls achieved level 2, while there were no differences in achievement at the other levels. For 16-year-old students, slightly more boys than girls achieved level 5. There were no differences in achievement between boys and girls at other levels.

CHART C11

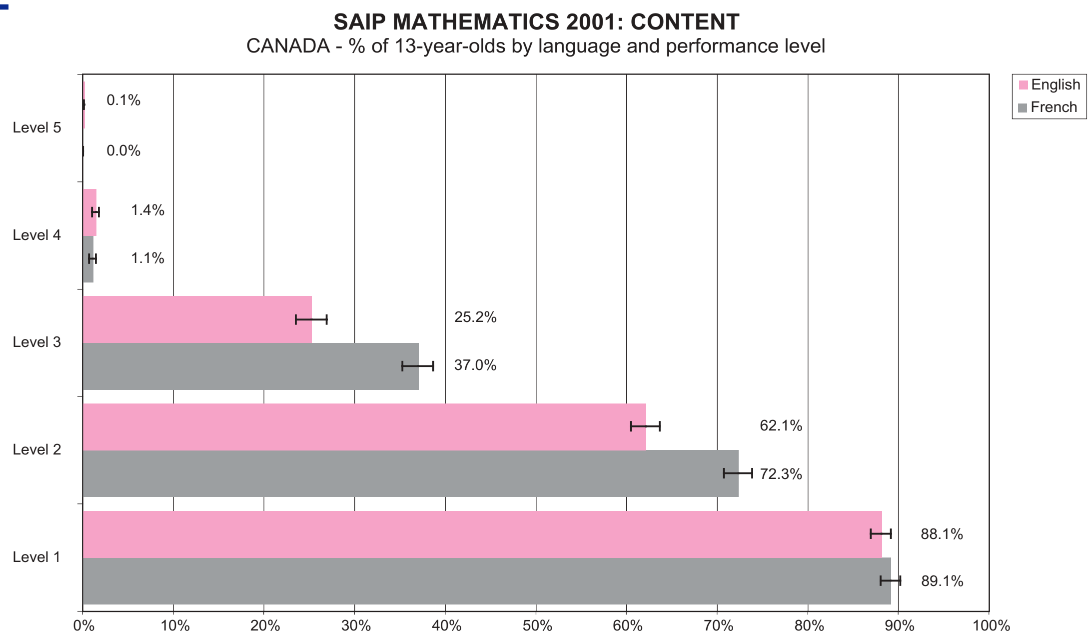
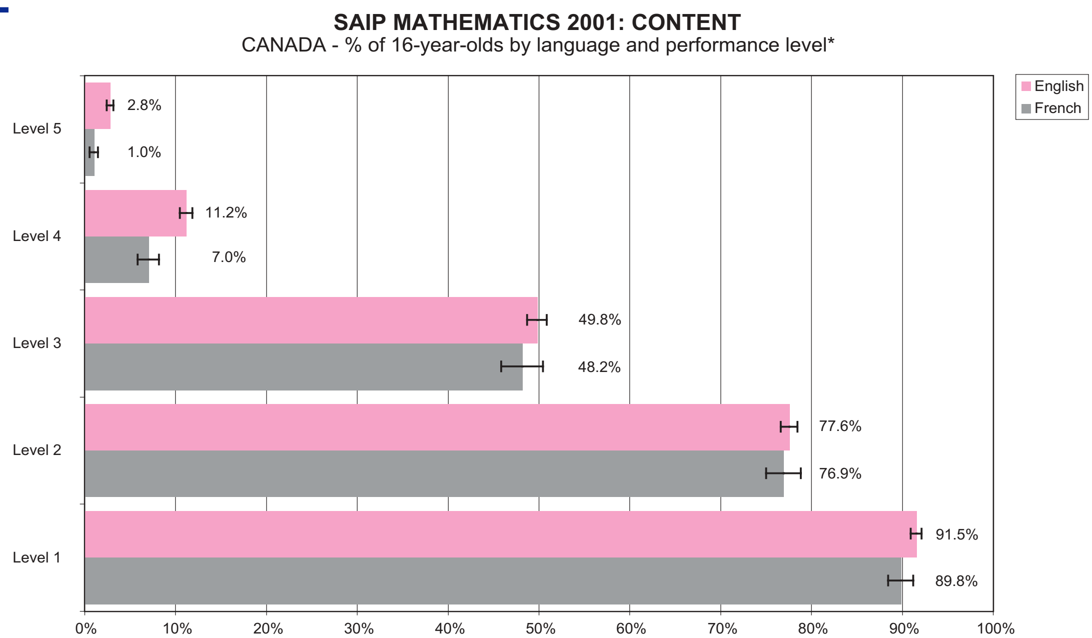


CHART C12



*These results do not include 16-year-old students from Quebec.

When mathematics content results for Canada are examined in terms of language, fewer 13-year-old students who wrote in English reached levels 2 and 3 than those who wrote in French.

For 16-year-old students, a population that does not include students from Quebec, more English-language students reached levels 4 and 5.

CHART C13

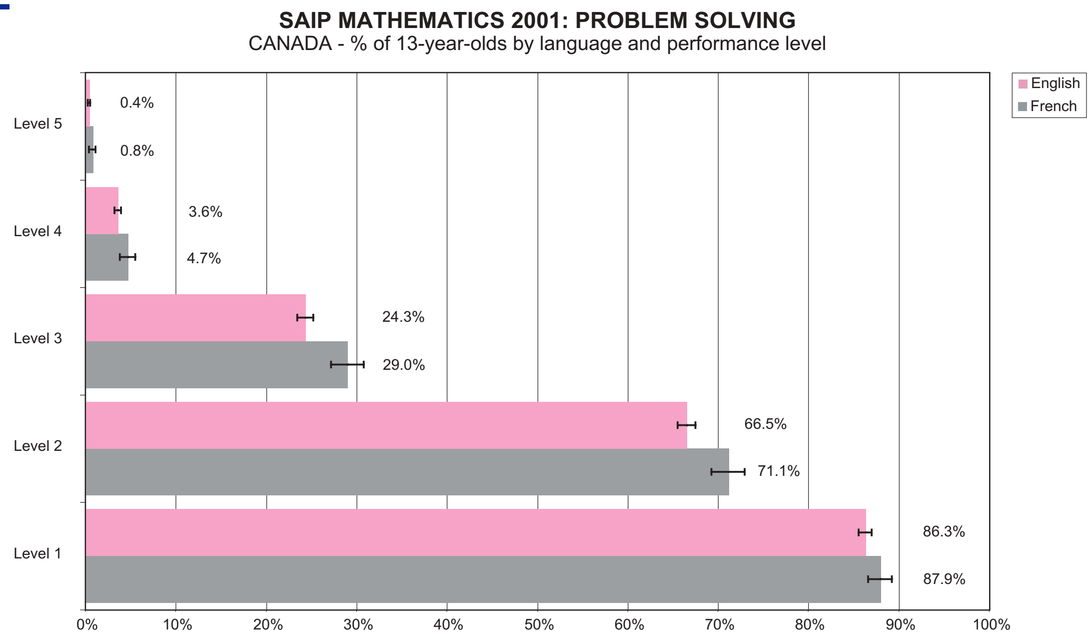
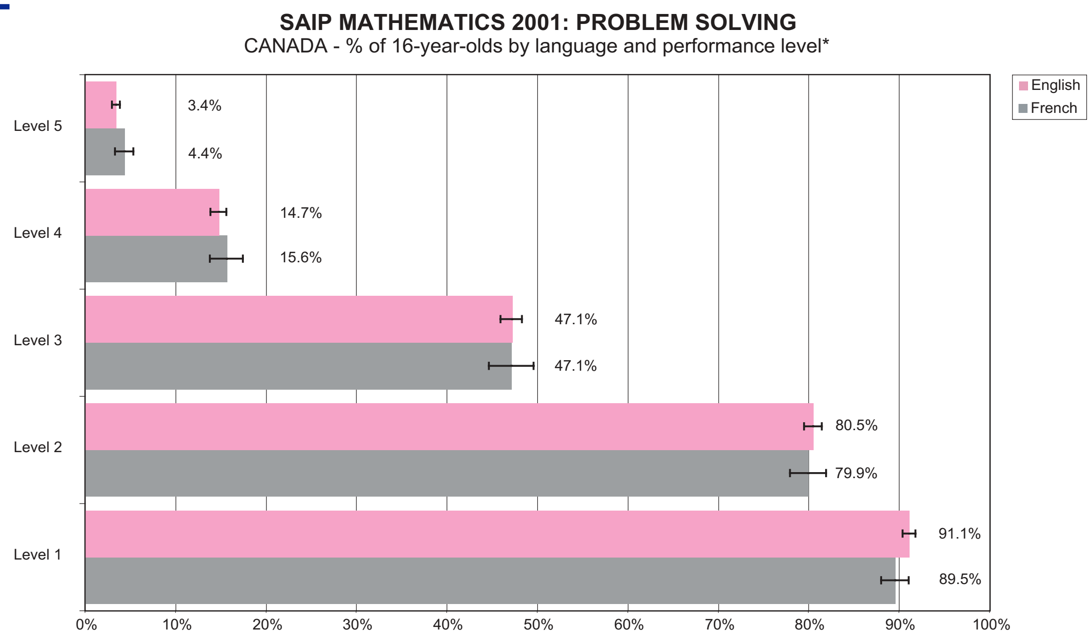


CHART C14



*These results do not include 16-year-old students from Quebec.

Canadian results for problem solving in terms of language show that more 13-year-old students who wrote in French performed at levels 2 and 3 than those who wrote in English.

For 16-year-old students, a population that does not include Quebec students, there were no significant differences at any level of performance.

This collaborative process asked a pan-Canadian panel of educators and non-educators to define pan-Canadian expectations for student achievement in mathematics. The results are found in charts C15 through C18. Specifically, participants were asked to answer independently the questions: "What percentage of Canadian students should achieve at or above each of the five performance levels, as illustrated by the framework and criteria and by the questions asked?"

Panellists' answers to that question were collected to determine the desired Canadian student performance and to help interpret how students should do in comparison with actual results.

A description of this important process is found on page 18 of this report.

In charts C15 through C18, the interquartile range of expectations and the median (mid-point) expectation are identified for each level of achievement. This range, presented as the screened colour around the median, represents the expectations set by 50% of the panellists. Where no screened colour appears, the range of expectations did not vary from the median.

CHART C15

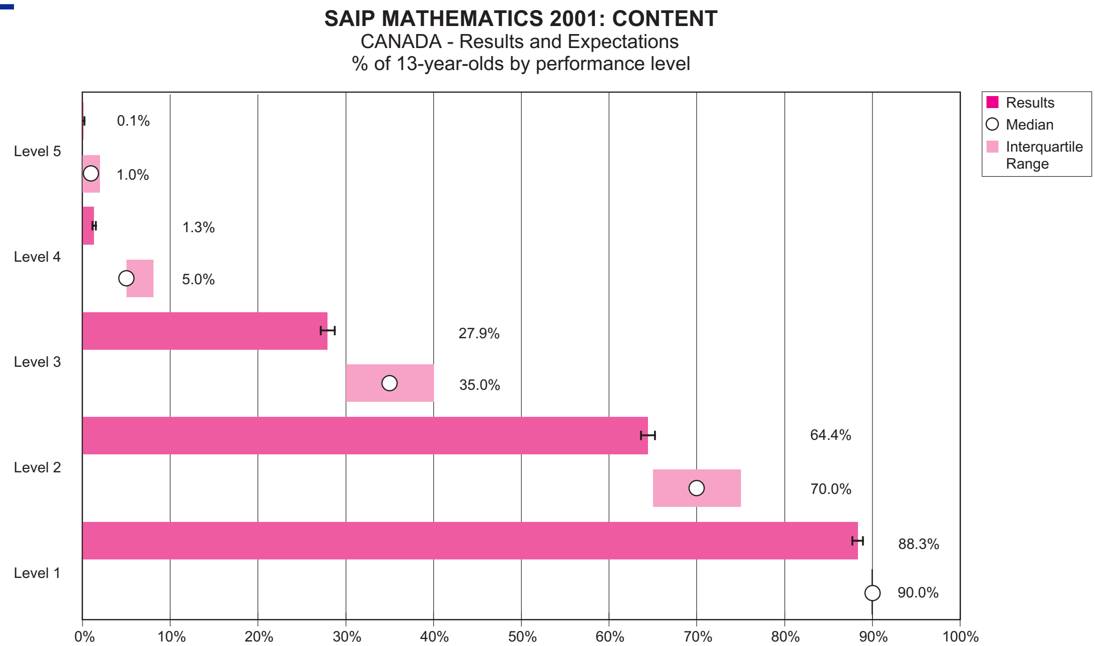
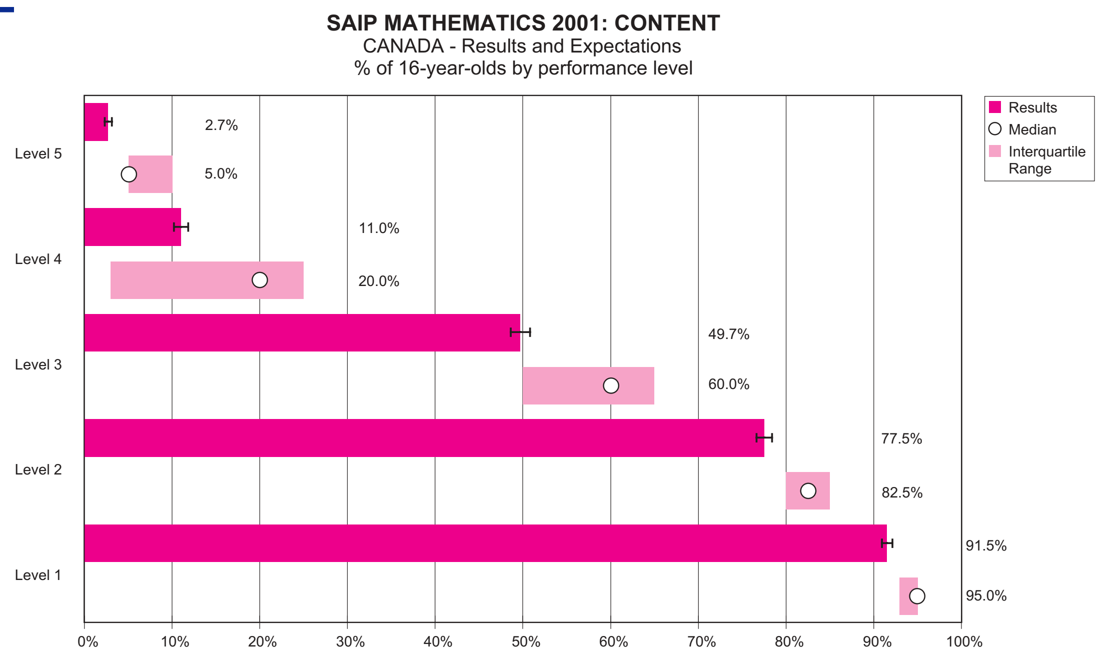


CHART C16



With respect to the mathematics content assessment, as shown on charts C15 and C16, the expectations of panellists were higher than the achievement of both 13-year-old and 16-year-old students.

CHART C17

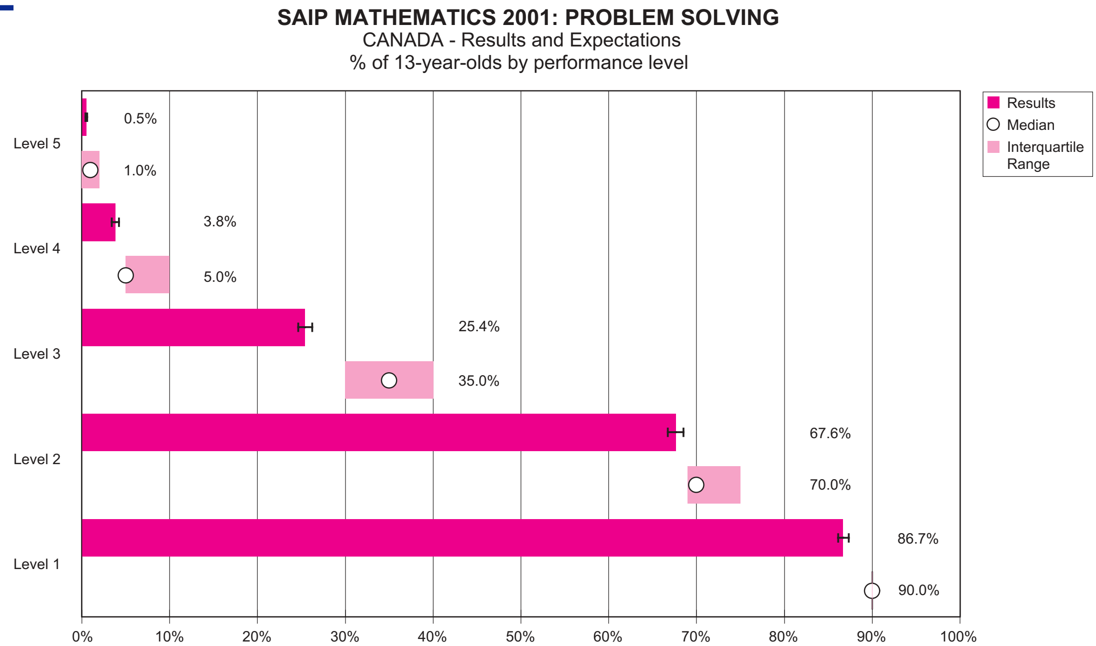
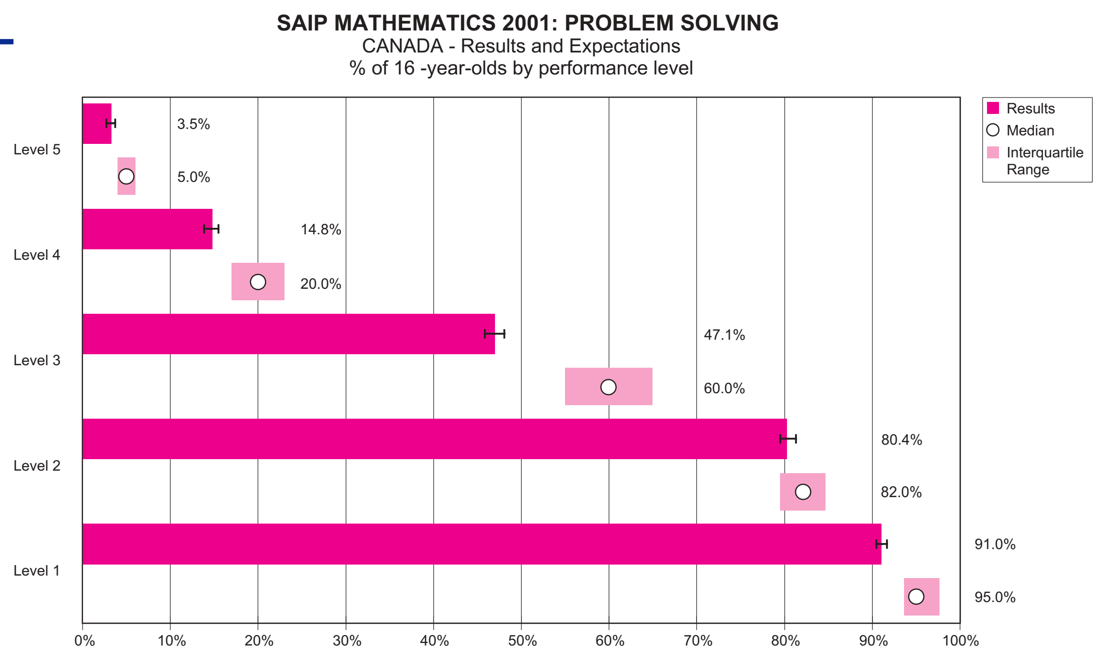


CHART C18



Charts C17 and C18 show that the panel of both educators and non-educators generally are not satisfied with the performance of Canadian students in the problem solving assessment.

The results of these expectation-setting sessions demonstrate the continuing high expectations that all Canadians hold for their students and their school systems.

RESULTS FOR THE JURISDICTIONS

In order to measure student achievement not only for Canada as a whole, but also for individual jurisdictions, a large enough number of students must be included in the sample for each jurisdiction.

OVERVIEW OF ACHIEVEMENT BY LEVEL

Table 3

Jurisdictions performing better than or about the same as Canada[1]

	Jurisdictions performing significantly better than[2] Canada	*Jurisdictions performing performing about the same as[2] Canada*
13-year-old students		
MATHEMATICS CONTENT (64.4% of Canadian 13-year-olds achieved level 2[3] or better.)	Alberta Quebec (F)	British Columbia Ontario (E) Quebec (E)
PROBLEM SOLVING (67.6% of Canadian 13-year-olds achieved level 2[3] or better.)	Alberta	Manitoba (F) Ontario (E) Ontario (F) Quebec (F) Quebec (E) New Brunswick (F) Nova Scotia (F) Yukon
16-year-old students[4]		
MATHEMATICS CONTENT (49.7% of Canadian 16-year-olds achieved level 3[3] or better.)	Alberta Manitoba (F)	British Columbia Manitoba (E) Ontario (E) New Brunswick (F) Nova Scotia (F) Yukon
PROBLEM SOLVING (47.1% of Canadian 16-year-olds achieved level 3[3] or better.)	Alberta Manitoba (F) New Brunswick (F)	British Columbia Saskatchewan Manitoba (E) Ontario (E) Nova Scotia (F)

[1] Jurisdictions are not necessarily in rank order.
[2] Differences in scores are statistically significant only when confidence intervals DO NOT overlap. Jurisdictions performing about the same as Canada as a whole have a confidence interval that overlaps that of Canada at the chosen level.
[3] Since the test designers designed instruments such that most 13-year-olds should achieve level 2 and most 16-year-olds level 3, these levels were chosen for this comparison.
[4] Quebec 16-year-olds did not participate.

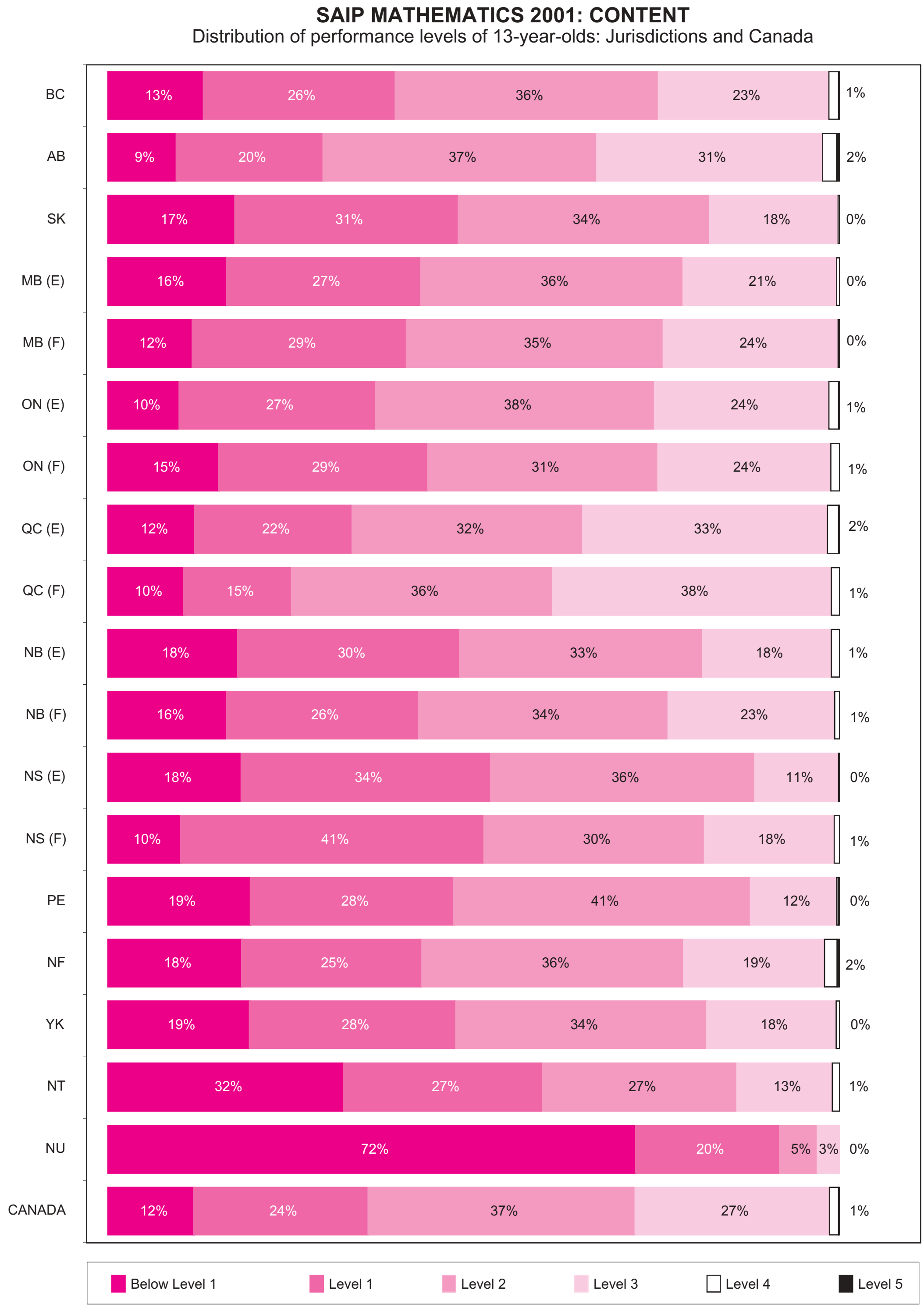
DISTRIBUTION OF PERFORMANCE LEVELS

Please note that the charts that follow (charts PL1–4) are not cumulative; that is, the bars represent the actual percentage of students at a particular level, rather than those who have achieved a particular level and above.

The following charts present the percentage of students at each achievement level for all jurisdictions plus Canada. The data shown constitute an overview and display the distribution of students at each achievement level. This is one useful way to present comparisons between jurisdictional results and with the Canadian results.

The results do vary from jurisdiction to jurisdiction. The charts show that some performed better than others. Achievement in some is significantly higher or lower than the Canadian results.

CHART PL1



Note: None of the jurisdictions had more than 0.5% of the 13-year-old student population achieving level 5 in mathematics content.

CHART PL2

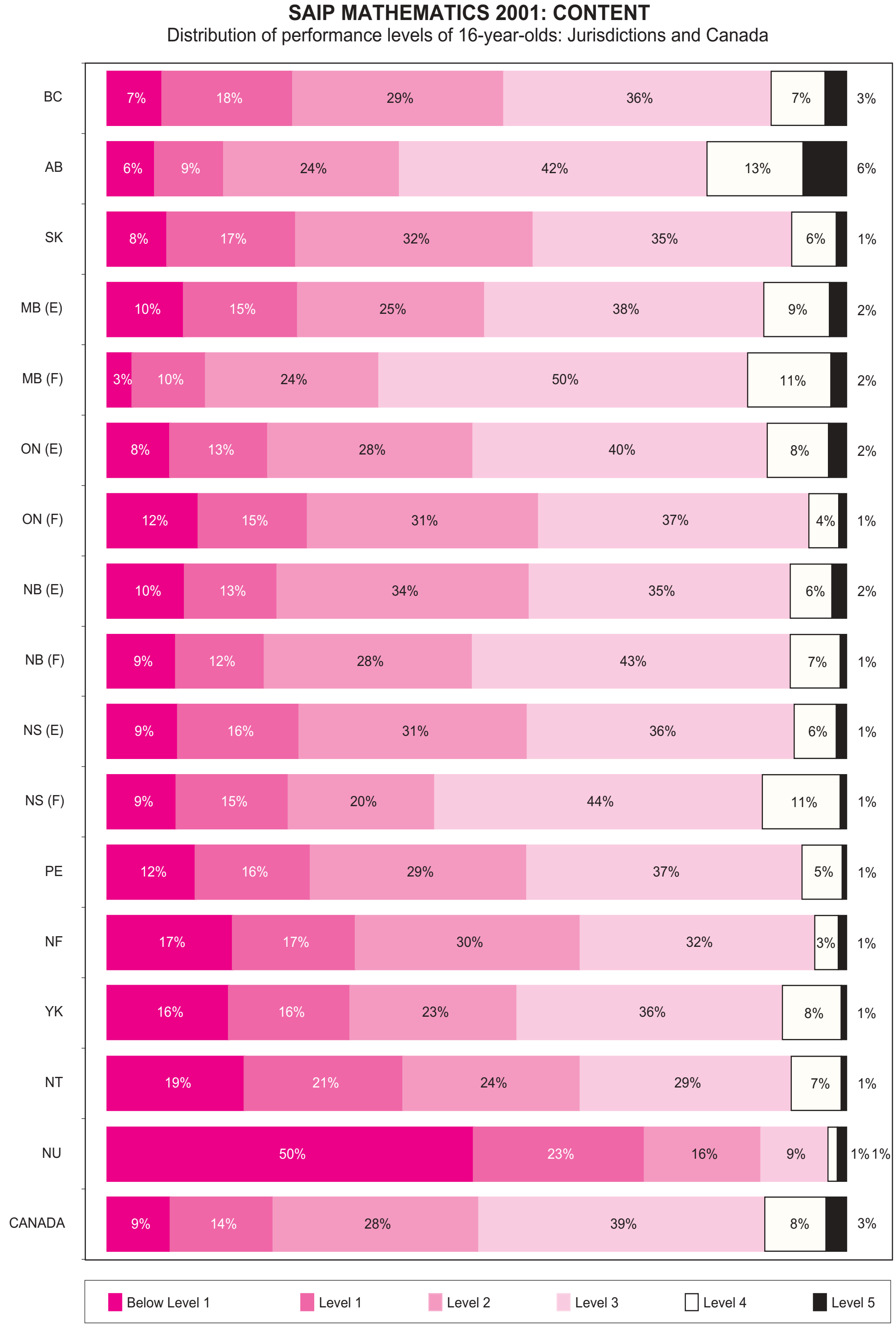

SAIP MATHEMATICS 2001: CONTENT
Distribution of performance levels of 16-year-olds: Jurisdictions and Canada
BC 7% 18% 29% 36% 7% 3%
AB 6% 9% 24% 42% 13% 6%
SK 8% 17% 32% 35% 6% 1%
MB (E) 10% 15% 25% 38% 9% 2%
MB (F) 3% 10% 24% 50% 11% 2%
ON (E) 8% 13% 28% 40% 8% 2%
ON (F) 12% 15% 31% 37% 4% 1%
NB (E) 10% 13% 34% 35% 6% 2%
NB (F) 9% 12% 28% 43% 7% 1%
NS (E) 9% 16% 31% 36% 6% 1%
NS (F) 9% 15% 20% 44% 11% 1%
PE 12% 16% 29% 37% 5% 1%
NF 17% 17% 30% 32% 3% 1%
YK 16% 16% 23% 36% 8% 1%
NT 19% 21% 24% 29% 7% 1%
NU 50% 23% 16% 9% 1% 1%
CANADA 9% 14% 28% 39% 8% 3%
Below Level 1
Level 1
Level 2
Level 3
Level 4
Level 5

CHART PL3

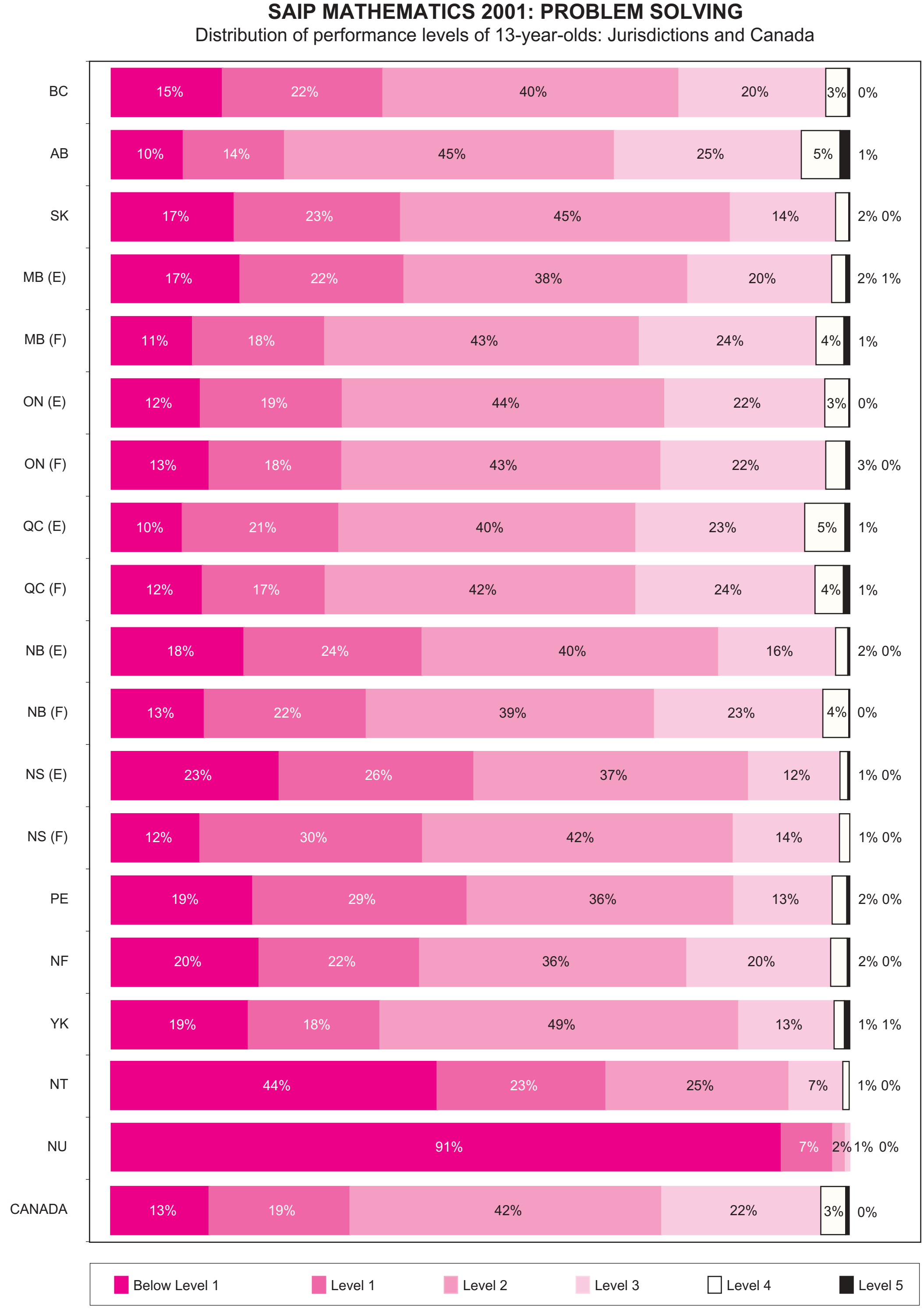

SAIP MATHEMATICS 2001: PROBLEM SOLVING
Distribution of performance levels of 13-year-olds: Jurisdictions and Canada
BC 15% 22% 40% 20% 3% 0%
AB 10% 14% 45% 25% 5% 1%
SK 17% 23% 45% 14% 2% 0%
MB (E) 17% 22% 38% 20% 2% 1%
MB (F) 11% 18% 43% 24% 4% 1%
ON (E) 12% 19% 44% 22% 3% 0%
ON (F) 13% 18% 43% 22% 3% 0%
QC (E) 10% 21% 40% 23% 5% 1%
QC (F) 12% 17% 42% 24% 4% 1%
NB (E) 18% 24% 40% 16% 2% 0%
NB (F) 13% 22% 39% 23% 4% 0%
NS (E) 23% 26% 37% 12% 1% 0%
NS (F) 12% 30% 42% 14% 1% 0%
PE 19% 29% 36% 13% 2% 0%
NF 20% 22% 36% 20% 2% 0%
YK 19% 18% 49% 13% 1% 1%
NT 44% 23% 25% 7% 1% 0%
NU 91% 7% 2% 1% 0%
CANADA 13% 19% 42% 22% 3% 0%
Below Level 1
Level 1
Level 2
Level 3
Level 4
Level 5

CHART PL4

SAIP MATHEMATICS 2001: PROBLEM SOLVING
Distribution of performance levels of 16-year-olds: Jurisdictions and Canada