Pan-Canadian Assessment Program

Council of Ministers of Education, Canada – PCAP 2010

# RESULTS FOR SECONDARY II STUDENTS IN QUÉBEC


Québec

**ISBN: 978-2-550-63615-1 (PDF)**

Legal deposit—Bibliothèque et Archives nationales du Québec, 2011

# Table of Contents

## List of Tables



## List of Charts

# 1. Introduction to the Pan-Canadian Assessment Program (PCAP)[1]

## 1.1 *Context of the study*

In 2003, the provincial and territorial ministers of education, through the Council of Ministers of Education, Canada (CMEC), agreed to develop the Pan-Canadian Assessment Program (PCAP) to replace its School Achievement Indicators Program (SAIP). This new program would periodically assess the knowledge and skills of Canadian 13-year-olds in reading, mathematics and science. The major component of each PCAP assessment would be one of these areas of learning, but each assessment would include minor components of the other two. PCAP is an excellent opportunity to show the education community, as well as the general public, the efficacy of our education systems with regard to learning in these subject areas. In order to make the exercise less arduous for schools, it was decided to use intact classes of Grade 8 students—or in the case of Québec, Secondary II students—for PCAP 2010 and subsequent assessments.

The first PCAP assessment was carried out in the spring of 2007. Its main component was reading. More than 35 000 students from over 1 500 Canadian schools wrote the assessment in either English or French.

The second PCAP assessment was carried out in the spring of 2010, and its main component was mathematics. More than 32 000 students from over 1 500 Canadian schools wrote the assessment. In Canada, of these 32 000 students, approximately 24 000 responded in English and 8 000 in French. In Québec, more than 5 200 students (more than 3 500 in French and more than 1 700 in English) and approximately 200 schools participated in PCAP 2010. These students answered questions in all three domains.

## 1.2 *Target group*

For PCAP 2010, mathematics was the major component, and reading and science were the minor ones. From May 3 to 14, 2010, a random sample of schools and Secondary II/Grade 8 classes across Québec and Canada participated in the assessment. In jurisdictions with small student populations, all the students were tested.

## 1.3 *Sampling procedure*

The number of participants must be high enough to adequately represent the performance of the population, which is made up of all eligible students in a given jurisdiction and linguistic group. The sample usually comprises 1 000 students per jurisdiction, with the sample for Québec including more than 5 000 students.

---

[1] This report on Québec's PCAP 2010 results contains excerpts reproduced with permission from the Canadian report published by the Council of Ministers of Education, Canada.

For this survey, stratified sampling was used. This included several stages of selection:

- random selection of a certain number of schools in each jurisdiction, drawn from a complete list of publicly funded schools provided by each of the jurisdictions (in Québec, all public and private secondary schools)
- random selection of Secondary II/Grade 8 classes using the list of all eligible classes in each of the schools

Where the numbers were lower than the desired level, all schools or classes in the jurisdiction that met the criteria were tested.

Therefore, in Canada, 34 607 students in Secondary II/Grade 8 were selected for the assessment. Of this number, 32 379 actually took the test. In Québec, 5 681 students were selected and 5 237 actually participated, that is, more than 92% of the students selected.

### *1.4 Correcting the examination*

The 2007 assessment used three booklets—two for the reading test and one for the mathematics and science tests. Approximately two thirds of the sample took the reading test and one third, the mathematics and science tests. The configuration changed for the 2010 assessment. Four booklets contained 158 questions divided as follows among the three domains: 100 questions in mathematics, 30 questions in reading and 28 questions in science. In other words, approximately 63% of the assessment items focused on mathematics, 19% on reading and 18% on science.

Each of the four booklets had the same random distribution across the Canadian sampling.

# 2. Results for Québec Students in Mathematics

## *2.1 Context of the mathematics test*

The mathematics curricula in various jurisdictions in Canada are structured around a number of mathematical processes deemed essential to the effective study of this subject. These generally include problem solving, reasoning and justifying thinking, reflecting, using appropriate tools and computation strategies, making connections within and outside the discipline, and representing and communicating mathematically. The processes reflect the way in which students acquire and apply their mathematical skills and knowledge and should not be separated from the skills and knowledge acquired through curriculum content.

The fundamental principle of the test is that applying mathematics is an integrated act and that the skills and concepts from one domain are by their very nature linked to various other domains. For the purposes of this test, mathematics is defined as the study of patterns and relationships and as a discipline that involves processes, connections and conceptual comprehension.

The scope of this test is limited to concepts and skills that are found and used in the classroom by most students in Grade 8 in Canada, which corresponds to Secondary II in Québec. However, it does not cover all the concepts and skills that a Secondary II/Grade 8 student is expected to have acquired in a given province.

## *2.2 Subdomains for the assessment of the mathematics component*

This test covers the following four subdomains:

- numbers and operations (properties, equivalent representations and magnitude)
- geometry and measurement (properties of 2-D figures and 3-D shapes, relative position, transformations and measurement)
- patterns and relationships (patterns and algebraic expressions, linear relations and equations)
- data management and probability (data collection and analysis, experimental and theoretical probability)

The subdomains in turn involve the following five processes (competencies):

- problem solving
- communication
- representation
- reasoning and proof
- connections

The five processes are interwoven throughout the subdomains of the mathematics assessment. Concepts cross over from one subdomain to another, while the mathematical processes are infused within the means by which students respond to the demands of a particular challenge.

### *2.3 Assessment design*

Like most human activities involving knowledge and skills, mathematics requires the integration of the many elements of the field of study when applied in the world at large. While the categorization and organization of mathematics into separate content strands and processes are needed to map the mathematical universe and develop a curriculum, the learning and application of mathematics involve linking multiple strands and processes; for example, we use measurement with operations, geometry, and even perhaps algebra, whether we are building a bookshelf or designing a space-shuttle launch.

The scope of this assessment is limited to those concepts and skills encountered and used in the courses of study of most Secondary II/Grade 8 students, without being a comprehensive assessment of all concepts and skills that a particular system expects Secondary II/Grade 8 students to master. The purpose of this assessment is to provide the jurisdictions with data to inform educational policy. It is not designed to identify the strengths or weaknesses of individual students, schools, school boards, districts or regions.

Consequently, the PCAP assessment in mathematics was organized into eight groups, or clusters, with scenarios requiring the engagement of multiple strands and processes. The eight clusters were distributed within four booklets. Each booklet contained two clusters of mathematics items, one reading cluster, and one science cluster. The four booklets were distributed randomly to students within a single class. Thus, every student completed two of the eight mathematics clusters of assessment items. In addition, all booklets contained a set of common items allowing for comparative measurements of student performance from one booklet to another.

Each PCAP mathematics cluster was composed of three to four scenarios with items spanning all four subdomains. Each scenario was comprised of one to six items assessing the various concepts and skills that are taught in mathematics and focused on their relevance for the context of the assessment cluster. Clusters were designed so that a student would need 90 minutes to complete all of the items in any one booklet. The clusters contained selected-response items and constructed-response items. The number of items per cluster varied slightly, depending on the distribution of item types in the cluster. No cluster contained only one type of item.

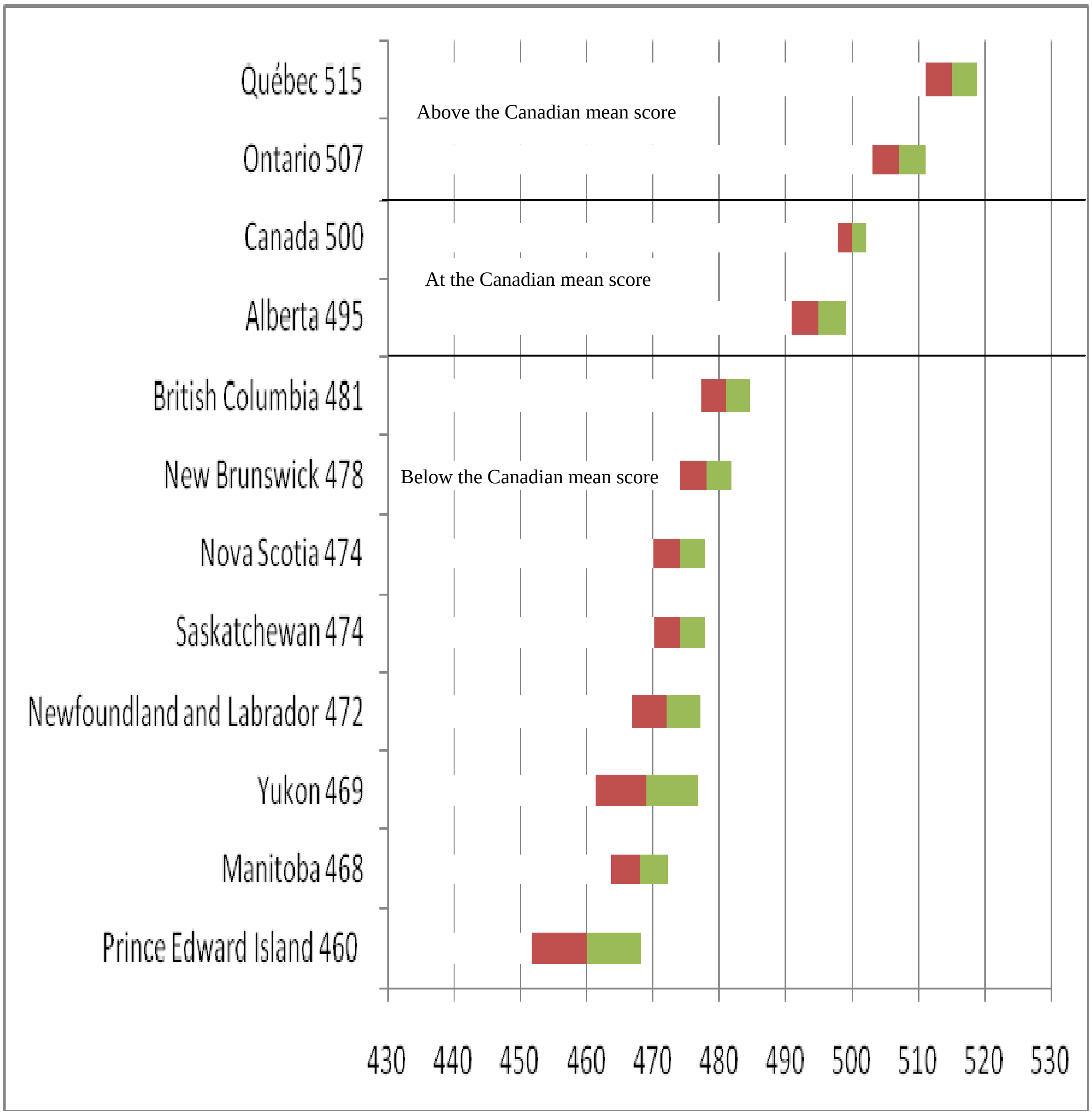
The assessment was designed at a reading level consistent with the literacy level expected of most Secondary II/Grade 8 students. Information in the items was presented in a variety of modes (e.g. graphically, in tables, symbolically). Because many jurisdictions in Canada assess the performance of both French- and English-language populations, English and French versions of the assessment were developed simultaneously and are considered to be equivalent. In addition, by assuring adequate representative sampling of these groups, this assessment provides statistically valid information at the jurisdictional level and for each of these linguistic groups.

### *2.4 Results for Québec students in mathematics*

This section illustrates the overall performance in mathematics of Secondary II/Grade 8 students in the PCAP 2010 assessment by comparing the overall performance (expressed as a mean score) of the ten Canadian provinces and one territory, the Yukon, with the mean score of all Canadian students.

The following chart provides the mean scores of each jurisdiction in the mathematics assessment, and the related confidence intervals, in comparison with the mean score of Canada.

**Chart 1 Mathematics mean scores by jurisdiction**



The following table presents the ranking of jurisdictions by their mean scores in mathematics.

**Table 1** **Ranking of jurisdictions by their mean scores in mathematics**

| Jurisdiction | Mean score | 95% confidence interval | Rank |
|---|---|---|---|
| **Québec** | **515** | **3.9** | 1 |
| Ontario | 507 | 4.0 | 2 |
| **Canada** | **500** | **2.2** | |
| Alberta | 495 | 4.0 | 3 |
| British Columbia | 481 | 3.6 | 4 |
| New Brunswick | 478 | 3.9 | 5 |
| Saskatchewan | 474 | 3.8 | 6 |
| Nova Scotia | 474 | 3.9 | 6 |
| Newfoundland and Labrador | 472 | 5.2 | 8 |
| Yukon | 469 | 7.7 | 9 |
| Manitoba | 468 | 4.2 | 10 |
| Prince Edward Island | 460 | 8.3 | 11 |

### *2.5 Explanation and presentation of the results by mathematics subdomain*

The mathematics test focused primarily on numbers and operations, geometry and measurement, patterns and relationships, and data management and probability. In numbers and operations, the mean score of Québec students is significantly higher than the mean score of Canadian students overall. Alberta and Ontario mean scores are not significantly different from the Canadian mean score. In geometry and measurement, the mean scores of Québec and Ontario students are significantly higher than the mean score of Canadian students overall. In patterns and relationships, the mean score of Ontario students is significantly higher than the mean scores of Canadian students overall and of other jurisdictions. The mean scores of students in Québec and Alberta are not significantly different from the Canadian mean score. In data management and probability, the mean score of Québec is significantly higher than the mean scores of Canadian students overall and of other jurisdictions. The mean scores of students in Ontario and Alberta are not significantly different from the Canadian mean score.

**Table 2** **Mathematics mean scores and confidence interval by jurisdiction and subdomain**

| **Subdomain** | **Numbers and operations** | | **Geometry and measurement** | | **Patterns and relationships** | | **Data management and probability** | |
|---|---|---|---|---|---|---|---|---|
| **Jurisdiction** | Mean score | 95% confidence interval | Mean score | 95% confidence interval | Mean score | 95% confidence interval | Mean score | 95% confidence interval |
| | | | | | | | | |
| British Columbia | 488 | 3.7 | 472 | 3.3 | 487 | 3.8 | 489 | 4.6 |
| Alberta | 501 | 4.3 | 485 | 3.9 | 495 | 4.0 | 496 | 5.4 |
| Saskatchewan | 488 | 3.7 | 464 | 3.8 | 473 | 4.0 | 477 | 5.0 |
| Manitoba | 476 | 4.5 | 459 | 3.3 | 478 | 4.2 | 473 | 5.7 |
| Ontario | 498 | 3.9 | 513 | 4.0 | 511 | 4.3 | 505 | 6.0 |
| **Québec** | **520** | **3.8** | **517** | **3.9** | **504** | **3.9** | **510** | **5.3** |
| New Brunswick | 487 | 3.7 | 472 | 3.9 | 476 | 4.3 | 489 | 5.4 |
| Nova Scotia | 477 | 3.8 | 477 | 3.8 | 475 | 3.8 | 488 | 5.1 |
| Prince Edward Island | 472 | 8.3 | 449 | 8.1 | 463 | 8.6 | 469 | 10.0 |
| Newfoundland and Labrador | 475 | 5.7 | 467 | 4.6 | 479 | 5.2 | 490 | 6.7 |
| Yukon | 482 | 7.8 | 466 | 6.8 | 473 | 7.7 | 466 | 10.4 |
| **Canada** | **500** | **2.1** | **500** | **2.0** | **500** | **2.1** | **500** | **3.1** |

Note: A shaded area indicates a result higher than Québec's.

## *2.6 Description of performance levels in mathematics*

Actual results of tests are called "raw scores." Initial analysis of raw scores involves the examination of the range of scores and the calculation of the "mean (average) score" obtained by the total population of participating students.

When scores obtained from different populations are to be compared over time and on different versions of a test, it becomes necessary to develop a common way of reporting achievement scores that will allow for direct comparisons across populations and tests. The common method used is to numerically convert the raw scores to "standard scale scores." In the case of PCAP 2010, the raw scores were converted to a scale on which the average for the pan-Canadian population was set at 500, with a standard deviation of 100. From this conversion, the scores of two thirds of all participating students fell within the range of 400 to 600 points, which represents a "statistically normal distribution" of scores. These derived "scale scores" are used to interpret more accurately the performance of students in each assessment and from one administration of the assessment to another. As well, the performance of the sample of students can be shown, within statistical limits, to be representative of the performance of the whole population of Secondary II/Grade 8 students. Once the set of scale scores has been established for the pan-Canadian population, the accurate comparison of achievement results of each jurisdiction's scores to the scale scores at the pan-Canadian level can be made.

This scale score was calculated using the same methodology as that used for the mathematics overall scale score (mean of 500 and a standard deviation of 100) for each of the subdomains: numbers and operations, geometry and measurement, patterns and relationships, and data management and probability.

In addition to the reporting of mean scale scores, the results for each jurisdiction are referenced to the levels of achievement using a performance scale. The performance levels represent how jurisdictional performances measured up to the expected level of achievement on two factors: cognitive demand and degree of difficulty of the items. The cognitive demands are defined by the level of reasoning required by the student to correctly answer an item from low demand to high demand, while the levels of difficulty are determined by a statistical determination based on the collective performance of the students on the assessment. This was accomplished by asking independent evaluators to establish standards, that is, to set the "cut scores" for each level, using the "bookmark" method. In other words, they determined the relative difficulty of the full set of assessment instruments and delineated the point along a scale that defines the achievement of each level of success, thus determining the "cut score." Once suitable cut scores were set, student performance within the range of cut scores could be refined. These refined descriptors of performance-level results more clearly indicated what students should know and be able to do at each level.

**Table 3** **Description of performance corresponding to each level of the general scale**

The four levels of performance were delineated as follows:

<table>
<tr><th>Level</th><th>Examples</th></tr>
<tr><td>Level 1<br><br>Scores of 357 points and less<br><br>Students at this level were able to solve problems at a low cognitive level that were determined to be fairly easy questions. Typically, at this level, students were able to retrieve information from a graph or solve previously learned routine problems. Problems at this level were mostly at the recall and recognition level.</td><td>The person who delivers Martine’s meals to her customers charges her a fee for the deliveries as shown in the table below.<br><br>Complete the table to show the total of the delivery charges for the week.<br><br><table><tr><td>Monday</td><td>$32.75</td></tr><tr><td>Tuesday</td><td>$27.40</td></tr><tr><td>Wednesday</td><td>$41.95</td></tr><tr><td>Thursday</td><td>$38.05</td></tr><tr><td>Friday</td><td>$65.25</td></tr><tr><td>Saturday</td><td>$49.50</td></tr><tr><td>Sunday</td><td>$46.40</td></tr><tr><td>Total</td><td></td></tr></table></td></tr>
</table>

| Level | Examples |
|---|---|
| **Level 2**<br><br>***Scores between 358 and 513 points***<br><br>Students at this level were required to recall facts, definitions, or terms and carry out previously learned procedures such as performing one or more operation, employing formulae, evaluating a variable expression, retrieving information from a table or a graph and applying it to solve a problem. Typically students at this level were able to identify a simple number of geometric patterns. The items students were able to solve were clearly defined as to what was required, with no extraneous information or hidden assumptions. Items at this level were mostly of low and moderate cognitive demand. | Mr. Robert rides his bike to school every day. He also uses his bike as a tool to teach his students a few concepts about circles.<br><br>What is the diameter of the front wheel of Mr. Robert's bike?<br><br><br><br>A. 45 cm<br><br>B. 80 cm<br><br>C. 85 cm<br><br>D. 90 cm |
| **Level 3**<br><br>***Scores between 514 and 668 points***<br><br>Students at this level were able to apply what they know to new situations, identify hidden assumptions, and distinguish between relevant and irrelevant information needed to solve a problem. They had to select appropriate procedures or strategies to solve a problem and sometimes had to apply skills from different domains to solve problems. Students at this level were able to represent a problem in different ways and use informal reasoning to solve problems. Questions at this level were mostly of moderate to high cognitive demand. | A talent show will start with a 10-minute introduction, and each skit is allowed 5 minutes. The talent show is scheduled to start at 7 p.m. and end at 9 p.m.<br><br><br><br>The total length of time of the talent show can be represented by the equation<br><br>$T = 10 + 5s$<br><br>where $T$ represents the total time of the show in minutes, and $s$ represents the number of skits.<br><br>**Using the equation, determine how many skits will be in the talent show.**<br><br>**Show your work.** |

| Level | Examples |
|---|---|
| **Level 4**<br><br>***Scores at 669 points and above***<br><br>Students at this level were able to solve problems that require complex reasoning at the analysis and synthesis levels. Solutions clearly show a mastery of the appropriate conceptual and procedural knowledge necessary to solve complex problems. Students were able to generalize a pattern and write the rule algebraically. They were also able to explain or justify their solutions and strategies clearly. Questions at this level were generally of high cognitive demand and determined to be difficult questions. | Sarah plays a game. After two weeks, Sarah has 105 points. After the third week, she has 135 points.<br><br>Which of the following could be used to calculate the percentage increase in Sarah's point total?<br><br>A. $\frac{135-105}{135}\times 100$<br><br>B. $\frac{135-105}{105}\times 100$<br><br>C. $\frac{135}{105}\times 100$<br><br>D. $\frac{105}{135}\times 100$ |

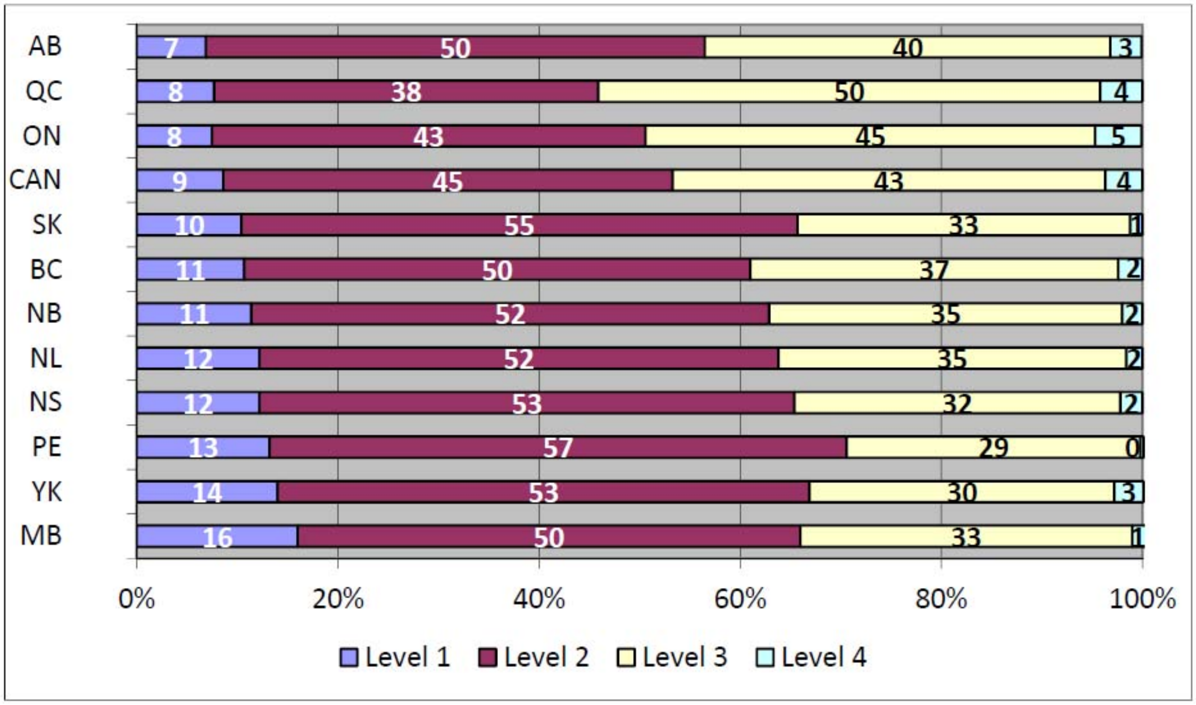
For the purpose of this assessment, a student was considered to achieve a particular performance level when he or she was able to achieve a score that was at or above the cut score for the level by answering correctly the items at that level two out of three times and therefore consistently demonstrate the defined characteristics for that particular level. Based on curriculum expectations in mathematics across Canada, Secondary II/Grade 8 students should be at level 2 or above. Students at level 1 are achieving at a level below that expected of students in their grade.

### *2.7 Pan-Canadian results by levels of performance*

Although using the mean score to describe achievement is useful in assessing the overall performance of students, further light can be cast by examining the relative distribution of scores in four levels of performance as described on the preceding page. Each level of performance is expressed as the percentage of students who have obtained a score within the range of scores attributed to a specific level. Level 2 is designated as the acceptable level of performance for Secondary II/Grade 8 students.

**Chart 2** **Percentage of students at each mathematics performance level by jurisdiction**

** The jurisdictions are listed in order from those with the highest percentages of students achieving level 2 and above to those with the lowest.*




The pan-Canadian results by levels of performance indicate that the majority of Secondary II/Grade 8 students achieve at or above the expected level of performance, that is, level 2. Across jurisdictions, the percentage of students at level 2 and above ranges from 84% to 93%. In three of the jurisdictions—Alberta, Ontario and Québec—92% or more of the students demonstrate performance at or above the Canadian expectation for this group.

Note: Only students that took the PCAP assessment are included in these tables. The school determined whether or not a student could be exempted from participating in the PCAP mathematics assessment. The reasons allowed for exemption included functional disability, intellectual disability, socioemotional condition, not having French or English as the mother tongue or having French or English as the language spoken at school for less than a year.

**Table 4** **Level of performance in mathematics – French**

| Jurisdiction | Level 1 (%) | Level 2 (%) | Level 3 (%) | Level 4 (%) |
|---|---|---|---|---|
| Alberta | 5 | 48 | 45 | 2 |
| Ontario | 6 | 43 | 46 | 5 |
| British Columbia | 6 | 44 | 47 | 3 |
| Nova Scotia | 7 | 48 | 42 | 3 |
| **Canada** | **8** | **38** | **50** | **4** |
| **Québec** | **8** | **37** | **51** | **4** |
| New Brunswick | 9 | 40 | 45 | 6 |
| Saskatchewan | 9 | 48 | 41 | 2 |
| Manitoba | 9 | 58 | 31 | 2 |

The percentage of students assessed in French in Alberta, Ontario, British Columbia and Nova Scotia who demonstrate performance at level 2 and above is higher than the percentage of Canadian students assessed in French overall. The percentage of students assessed in French in Québec who demonstrate performance at level 2 and above is equal to that of Canadian students assessed in French overall. The percentage of students assessed in French in Québec who demonstrate performance at level 3 is higher than the percentage of Canadian students assessed in French overall.

**Table 5 Level of performance in mathematics – English**

| Jurisdiction | Level 1 (%) | Level 2 (%) | Level 3 (%) | Level 4 (%) |
|---|---|---|---|---|
| Ontario | 7 | 44 | 44 | 5 |
| Alberta | 7 | 50 | 40 | 3 |
| **Canada** | **8** | **47** | **41** | **4** |
| **Québec** | **8** | **43** | **44** | **5** |
| British Columbia | 10 | 51 | 36 | 3 |
| Saskatchewan | 11 | 54 | 34 | 1 |
| Nova Scotia | 13 | 53 | 32 | 2 |
| New Brunswick | 13 | 55 | 31 | 1 |
| Newfoundland and Labrador | 14 | 50 | 35 | 2 |
| Yukon | 15 | 50 | 32 | 2 |
| Prince Edward Island | 15 | 54 | 31 | 0 |
| Manitoba | 16 | 50 | 33 | 1 |

The percentage of students assessed in English in Alberta and Ontario who demonstrate performance at level 2 and above is higher than the corresponding percentage of Canadian students assessed in English overall. The percentage of students assessed in English in Québec who demonstrate performance at level 2 and above is equal to that of Canadian students assessed in English overall. The percentage of students assessed in English in Ontario and Québec who demonstrate performance at level 3 is higher than the percentage of Canadian students assessed in English overall.

# 3. Results for Québec Students in Reading

### *3.1 Context of the reading test*

Items pertaining to reading and science were included in the test booklets. Students were required to answer approximately 40 questions in 90 minutes. The test contained selected-response and constructed-response items. The number of items per scenario varied slightly, depending on the distribution of types of items within a scenario; however, no scenarios contained only one type of item. For the assessment to be accessible to all participating students, it was ensured that the reading level and vocabulary were appropriate for Secondary II/Grade 8 students.

Contemporary concepts of reading recognize that the process of reading depends on interaction between the reader, text, purpose and context before, during and after reading. It is also acknowledged that reading is not a finite set of skills, knowledge and concepts; rather, it is a process of continuous growth during which readers push the limits of their comprehension, interpretation, reaction and reflection regarding the text. In doing this, they work on mastering the entire reading process.

The process of reading effectively involves the interaction of reader, text, purpose and context before, during and after reading. In order to make meaning of a text, readers must make a connection between what is in the text and what they know or bring to the text. Readers' personal experiences, real or vicarious, allow a greater or lesser access to the content and forms of what they read. Knowledge of language, facility with language strategies, and knowledge of the way language works in print affect the student's construction of meaning in the text.

Writers produce texts for a variety of purposes and use a variety of forms. Currently, many of the traditional genres have been combined or used in novel ways. Students must read a variety of texts such as those generally considered fiction and those considered nonfiction. Within that range, texts have different degrees of complexity in structure, vocabulary, syntax, organization, ideas, rhetorical devices and subject matter. To read these forms or types successfully, students need to recognize how these forms or types of text function in different situations.

The purpose of the reading activity affects the reader's construction of meaning. Students read texts for a variety of purposes, ranging from the pleasure they take in the text's content and style to the practical information or point of view they acquire from engaging with it. Whereas particular forms or types of text are often considered aesthetic or pragmatic in intention, the reader's purpose may differ from that intent. For example, social studies students may be required to read a novel to develop knowledge of a particular culture, era or event.

Context is important in any reading act because it affects the stance the reader takes toward the printed word. Context refers specifically to the physical, emotional, social and institutional environment at the time of reading. Any meaning constructed by a reader is a reflection of the social and cultural environment in which the reader lives and reads. Peer, family and community values affect the stance readers take as they engage with text.

The reading curriculum makes a distinction between personal response and critical response to text.

A personal response implies that students think about their own experiences in light of the text or that they recognize themselves in certain aspects of the text. Students explain their reaction or the connections they make with the text by developing explanations, examples and arguments based on their own experience and knowledge. They find material in the text to back up their assertions and personal opinions on the issues, themes, characters and situations.

A critical response implies that the readers are distancing themselves from the text, and evaluating the quality and relevance of it with respect to the world in general. They evaluate the content, the elements of style or the position of the author, and reflect on the choices of content, sources, quality, relevance in time or usefulness of the information, the relationships and the ideas. They justify their reaction using evidence, and precise, appropriate details taken from the text and other sources related to the problems, themes, characters and elements presented.

### *3.2 Subdomains for the assessment of the reading component*

In light of the interactive process linking the reader, text, purpose and context, this assessment of the domain of reading considers the reader’s engagement with the text and his or her response to it. Language arts curricula across Canada identify comprehension, interpretation, and response and reflection as major organizing aspects of reading literacy. In this assessment, three subdomains of the integrated process of reading are assessed:

- comprehension
- interpretation
- response to text (which includes response and reflection)

*Comprehension*
Readers construct the meaning of a text using the information provided explicitly and implicitly by the vocabulary, the parts of the text, its components and related events.

*Interpretation*
The students construct the meaning of a text by analyzing the parts, the elements and the events, and by combining them to obtain a broader perspective or a deeper meaning. They identify the theme or argument and substantiate their perception through references to details, events, symbols, patterns and characteristics of the text.

*Response to text*
Readers react to a text in various ways:

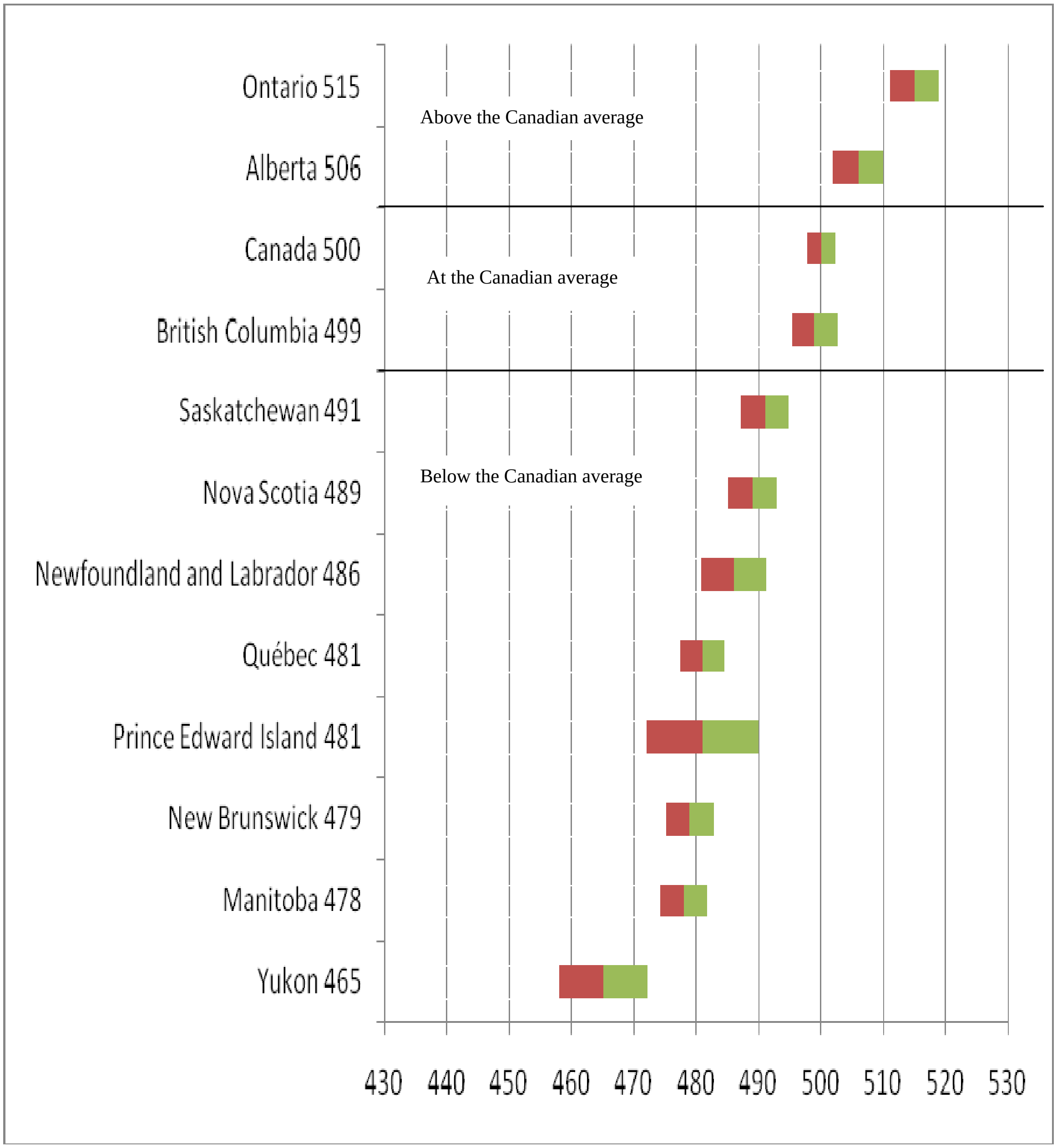
- in making personal connections between certain aspects of the text and what they have experienced, directly or through another person, their knowledge, their values and their own perspectives
- through an emotional reaction to the central ideas or certain aspects of the text
- by evaluating its quality or its value, possibly in relationship to other texts or to social or cultural factors

### *3.3 Results for Québec students in reading*

This section illustrates the overall performance in reading for Secondary II/Grade 8 students in the PCAP 2010 assessment by comparing the overall performance (expressed as a mean score) of the ten Canadian provinces and one territory, the Yukon, with the mean score of all Canadian students.

The following chart provides the mean scores of each jurisdiction in the reading assessment, and the related confidence intervals, in comparison with the mean score of Canada.

**Chart 3 Reading mean scores by jurisdiction**



The following table presents the ranking of jurisdictions by their mean scores in reading.

**Table 6** **Ranking of jurisdictions by their mean scores in reading**

| Jurisdiction | Mean score | 95% confidence interval | Rank |
|---|---|---|---|
| Ontario | 515 | 3.9 | 1 |
| Alberta | 506 | 4.0 | 2 |
| **Canada** | **500** | **2.2** | |
| British Columbia | 499 | 3.7 | 3 |
| Saskatchewan | 491 | 3.9 | 4 |
| Nova Scotia | 489 | 4.0 | 5 |
| Newfoundland and Labrador | 486 | 5.2 | 6 |
| **Québec** | **481** | **3.6** | **7** |
| Prince Edward Island | 481 | 9.0 | 7 |
| New Brunswick | 479 | 3.9 | 9 |
| Manitoba | 478 | 3.8 | 10 |
| Yukon | 465 | 7.1 | 11 |

# 4. Results for Québec Students in Science

### *4.1 Context of the science test*

The concept of "scientific literacy" is generally accepted as the overarching goal of science curricula across Canada. The PCAP science assessment is founded on a definition of scientific literacy that advocates that students' evolving competencies in applying science-related attitudes, skills and knowledge, as well as an understanding of the nature of science, enable them to conduct inquiries, solve problems and make evidence-based decisions about science-related issues. Embedded in this definition of scientific literacy is the supposition that students have knowledge of the life sciences, physical sciences (chemistry and physics), and earth and space sciences, as well as an understanding of the nature of science as a human endeavour.

As reflected in most science curriculum documents across Canadian provinces and territories, three competencies are associated with demonstrating scientific literacy: science inquiry, problem solving and decision making. Each of these competencies requires understanding the nature of science, applying relevant scientific knowledge, using skills, and demonstrating attitudes as a reflection of scientific literacy. For the purposes of PCAP 2010, all of these are considered interrelated and mutually supportive.

Additionally, one of the purposes of PCAP as identified by CMEC was to align itself with international assessments such as the Organisation for Economic Co-operation and Development's (OECD) Programme for International Student Assessment. Adopting a similar definition of scientific literacy enhances the possibility of finding some areas of comparability between the two assessments.

Finally, although the design of this framework and the resulting items have been consistent with the intent of science curricula across Canada, the PCAP science assessment is not a comprehensive assessment that includes every aspect of science and all the content knowledge in every science curriculum for Secondary II/Grade 8 students. One of the important aspects of the Québec curriculum pertains to technology and this dimension is only briefly touched upon in a few questions of this assessment.

### *4.2 Subdomains for the assessment of the science component*

The science component covers the following five subdomains:

- nature of science (understanding the nature of scientific knowledge and the processes by which that knowledge develops)
- nature of technology (recognizing the interrelationships between science and technology)
- knowledge of science (knowing theories, models, concepts, and principles in the various strands of science: life sciences [biology], physical sciences [chemistry and physics], and earth and space sciences)

- skills (applying competencies to real-life situations in order to solve problems and make informed decisions); the subdomain of skills has been categorized into four strands: identifying and planning, performing and recording, analyzing and interpreting, and communication
- attitudes (developing positive attitudes such as interest in science, awareness of science-related issues, respect and support for evidence-based knowledge, and awareness of sustainable development and stewardship)

The science component also covers the following three processes (competencies):

- science inquiry (addressing questions about the nature of things, involving broad explorations as well as focused investigations)
- problem solving (seeking answers to practical problems requiring the application of their science knowledge in new ways)
- decision making (identifying questions or issues, researching science knowledge for information about the question or issue, and making personal judgments or decisions)

The science assessment comprises items associated with the competencies and subdomains that provide opportunities for students to demonstrate their use of science-related attitudes, skills and knowledge. The competencies and the combination of the five interrelated subdomains as defined by curricula across Canada, as well as the statements in CMEC's *Common Framework of Science Learning Outcomes K to 12*, provided the foundation for the development of all test items.

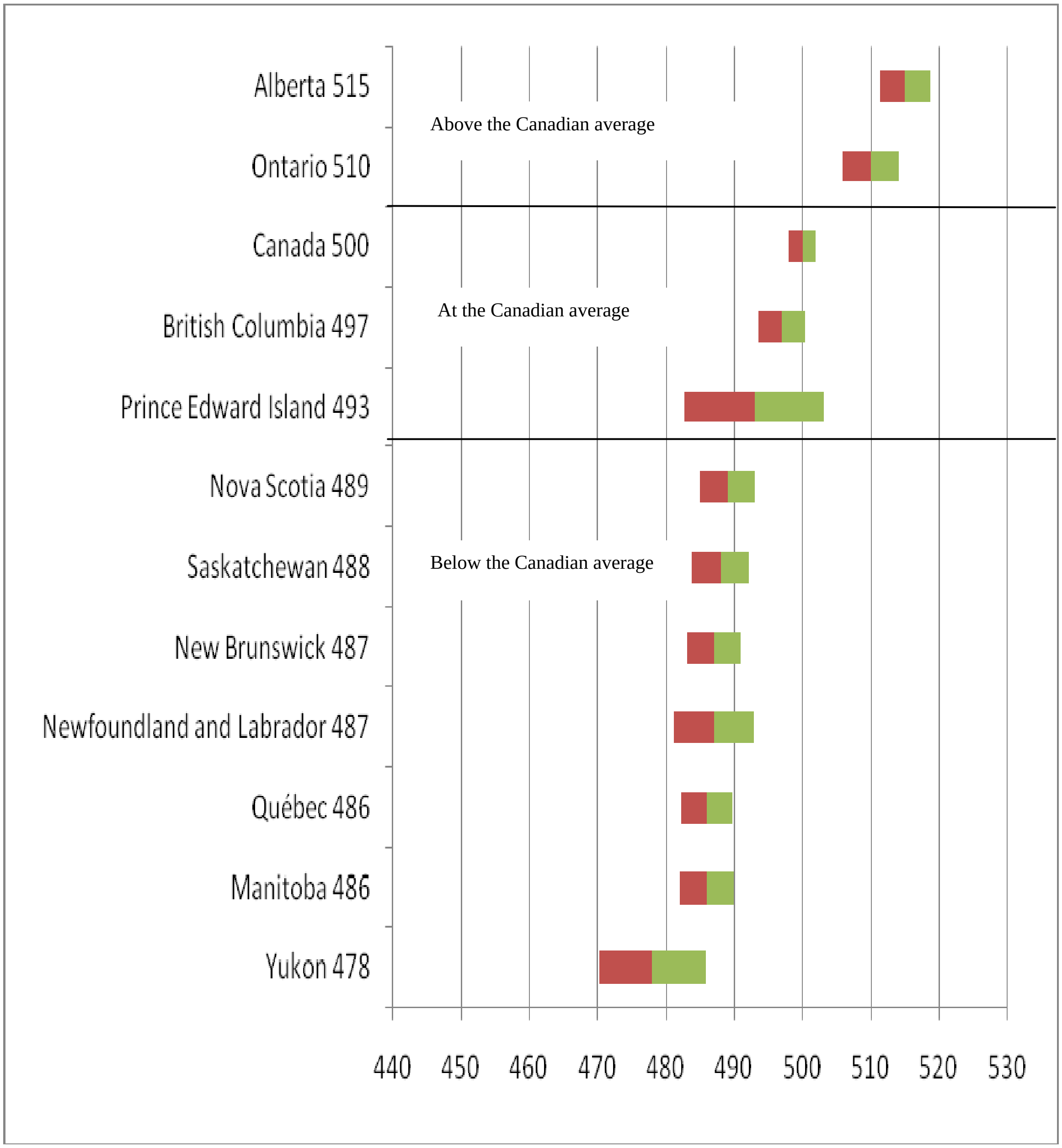
The PCAP 2010 science component comprised sets of items, each set defined (contextualized) by a specific scenario. Efforts were made to ensure that the contexts of the various scenarios were drawn from situations that were relevant, appropriate and sensible for Secondary II/Grade 8 students.

### *4.3 Results for Québec students in science*

This section illustrates the overall performance in science for Secondary II/Grade 8 students in the PCAP 2010 assessment by comparing the overall performance (expressed as a mean score) of the ten Canadian provinces and one territory, the Yukon, with the mean score of all Canadian students.

The following chart provides the mean scores for each jurisdiction in the science assessment, and the related confidence intervals, in comparison with the mean score of Canada.

**Chart 4** **Science mean scores by jurisdiction**



The following table presents the ranking of jurisdictions by their mean scores in science.

**Table 7 Ranking of jurisdictions by their mean scores in science**

| Jurisdiction | Mean score | 95% confidence interval | Rank |
|---|---|---|---|
| Alberta | 515 | 3.7 | 1 |
| Ontario | 510 | 4.1 | 2 |
| **Canada** | **500** | **2.0** | |
| British Columbia | 497 | 3.4 | 3 |
| Prince Edward Island | 493 | 10.2 | 4 |
| Nova Scotia | 489 | 4.0 | 5 |
| Saskatchewan | 488 | 4.2 | 6 |
| New Brunswick | 487 | 3.9 | 7 |
| Newfoundland and Labrador | 487 | 5.8 | 7 |
| **Québec** | **486** | **3.8** | **9** |
| Manitoba | 486 | 3.9 | 9 |
| Yukon | 478 | 7.8 | 11 |

# 5. Comparisons of Mean Scores by Gender

### *5.1 Comparison of mathematics mean scores*

Unlike all the other international surveys, in Canada, the mean scores of male and female students are almost identical. Males have a slight, insignificant advantage of 5 points over females. PCAP 2010 shows that females once again did almost as well as males in mathematics, as they did in the 2007 assessment.

In Québec, there is an insignificant difference of 10 points in favour of male students. Similarly, in five other provinces and the territory, males outperform females. Only British Columbia shows a significant difference of 15 points in favour of males. In the other four provinces, females did better than males and only New Brunswick has a significant difference of 12 points in favour of females. In the remaining provinces and the Yukon, insignificant differences range from 1 to 15 points either in favour of females or males.

The percentage of female students performing at level 2 and above is the same as their male counterparts. However, more males demonstrate higher level mathematics skills and knowledge, with the percentage of males achieving level 3 and above being higher than that of females.

**Table 8 Comparison of mathematics mean scores by gender**

| Comparison of mathematics mean scores by gender | | | | | |
|---|---|---|---|---|---|
| **Jurisdiction** | Male | 95% confidence interval | Female | 95% confidence interval | Difference (Female-Male) |
| British Columbia | 490 | 5.4 | 475 | 4.9 | -15 |
| Alberta | 500 | 4.8 | 491 | 4.8 | -9 |
| Saskatchewan | 477 | 5.0 | 475 | 5.3 | -2 |
| Manitoba | 470 | 6.0 | 468 | 5.1 | -3 |
| Ontario | 508 | 5.8 | 509 | 6.1 | 1 |
| **Québec** | **523** | **5.5** | **513** | **4.6** | **-10** |
| New Brunswick | 473 | 5.3 | 486 | 5.8 | 12 |
| Nova Scotia | 473 | 5.9 | 478 | 4.6 | 5 |
| Prince Edward Island | 468 | 11.7 | 453 | 11.1 | -15 |
| Newfoundland and Labrador | 471 | 8.0 | 476 | 6.4 | 5 |
| Yukon | 481 | 11.9 | 470 | 11.6 | -11 |
| **Canada** | **504** | **2.9** | **499** | **3.0** | **-5** |

Note: Shaded areas indicate significant differences.

### *5.2 Comparison of reading mean scores*

Hardly surprisingly, the results show us once again that female students do better than males in reading. In the various jurisdictions, females outperform males with differences ranging from 7 points in the Yukon to 39 points in New Brunswick. In Québec, this difference is 27 points compared to the Canadian mean score of 26 points. Only the Yukon has an insignificant difference in reading.

**Table 9 Comparison of reading mean scores by gender**

| Comparison of reading mean scores by gender | | | | | |
|---|---|---|---|---|---|
| **Jurisdiction** | Male | 95% confidence interval | Female | 95% confidence interval | Difference (Female-Male) |
| British Columbia | 491 | 5.4 | 511 | 5.7 | 20 |
| Alberta | 497 | 4.5 | 516 | 5.4 | 19 |
| Saskatchewan | 482 | 5.1 | 504 | 5.9 | 22 |
| Manitoba | 466 | 5.9 | 494 | 5.5 | 28 |
| Ontario | 503 | 5.6 | 530 | 6.1 | 27 |
| **Québec** | **471** | **5.4** | **498** | **4.5** | **27** |
| New Brunswick | 462 | 5.9 | 501 | 4.9 | 39 |
| Nova Scotia | 480 | 5.8 | 501 | 5.0 | 21 |
| Prince Edward Island | 474 | 13.6 | 491 | 13.5 | 17 |
| Newfoundland and Labrador | 468 | 7.3 | 506 | 7.4 | 38 |
| Yukon | 467 | 10.8 | 474 | 11.9 | 7 |
| **Canada** | **489** | **3.3** | **515** | **2.6** | **26** |

Note: Shaded areas indicate significant differences.

### *5.3 Comparison of science mean scores*

In Québec and Canada, female students have a significant advantage of 11 points over male students. In the other provinces, females outperform males with differences ranging from 4 points in British Columbia to 22 points in New Brunswick. Only the Yukon has a 14-point advantage in favour of males. Six provinces have a significant difference in favour of females varying between 11 and 22 points. Four other provinces have insignificant differences ranging from 4 to 9 points in favour of females and the Yukon presents an insignificant difference of 14 points in favour of males.

**Table 10 Comparison of science mean scores by gender**

| Comparison of science mean scores by gender | | | | | |
|---|---|---|---|---|---|
| **Jurisdiction** | Male | 95% confidence interval | Female | 95% confidence interval | Difference (Female-Male) |
| British Columbia | 497 | 4.6 | 501 | 5.1 | 4 |
| Alberta | 511 | 5.3 | 520 | 5.2 | 9 |
| Saskatchewan | 483 | 5.5 | 497 | 6.6 | 15 |
| Manitoba | 485 | 6.5 | 490 | 7.0 | 6 |
| Ontario | 505 | 5.6 | 517 | 5.5 | 12 |
| **Québec** | **483** | **5.4** | **494** | **5.0** | **11** |
| New Brunswick | 478 | 5.2 | 500 | 6.1 | 22 |
| Nova Scotia | 482 | 5.8 | 499 | 5.1 | 17 |
| Prince Edward Island | 491 | 14.2 | 497 | 13.6 | 6 |
| Newfoundland and Labrador | 481 | 7.3 | 497 | 7.3 | 15 |
| Yukon | 492 | 12.0 | 477 | 12.0 | -14 |
| **Canada** | **496** | **3.1** | **507** | **2.7** | **11** |

Note: Shaded areas indicate significant differences.

# 6. Comparisons of Mean Scores By Language of Instruction

## *6.1 Comparison of mathematics mean scores*

Québec students did very well on the PCAP 2010 mathematics assessment. The mean scores of students assessed in French and students assessed in English are very close, with an insignificant difference of 9 points.

Taken separately, Québec students assessed in French rank first among the jurisdictions participating in PCAP 2010. Québec students assessed in English rank second, along with Ontario. In the combined score, Québec students rank first in the mathematics assessment.

**Table 11 Comparison of mathematics mean scores and confidence interval, by jurisdiction and by language of instruction**

| **Mathematics mean scores and confidence interval by jurisdiction, by language of instruction** | | | | | | |
|---|---|---|---|---|---|---|
| **Mean score by language of instruction** | **Combined score** | | **French, language of instruction** | | **English, language of instruction** | |
| **Jurisdiction** | Mean score | 95% confidence interval | Mean score | 95% confidence interval | Mean score | 95% confidence interval |
| British Columbia | 481 | 3.6 | 504 | 5.0 | 481 | 3.8 |
| Alberta | 495 | 4.0 | 504 | 5.3 | 495 | 3.9 |
| Saskatchewan | 474 | 3.8 | 498 | 7.1 | 474 | 3.8 |
| Manitoba | 468 | 4.2 | 480 | 3.5 | 467 | 4.2 |
| Ontario | 507 | 4.0 | 511 | 3.7 | 507 | 4.7 |
| **Québec** | **515** | **3.9** | **516** | **3.5** | **507** | **6.6** |
| New Brunswick | 478 | 3.9 | 507 | 5.3 | 466 | 4.9 |
| Nova Scotia | 474 | 3.9 | 503 | 3.2 | 473 | 4.3 |
| Prince Edward Island | 460 | 8.3 | | | 460 | 10.3 |
| Newfoundland and Labrador | 472 | 5.2 | | | 472 | 5.2 |
| Yukon | 469 | 7.7 | | | 468 | 8.2 |
| **Canada** | **500** | **2.2** | **515** | **3.8** | **495** | **2.4** |

Note: Shaded areas indicate significant differences.

### *6.2 Comparison of reading mean scores*

Québec students did not do very well on the PCAP 2010 reading assessment. There is a significant difference of -12 points between Québec students assessed in French and those assessed in English, with the latter having performed slightly better.

Taken separately, Québec students assessed in English rank fourth among the participating jurisdictions, whereas Québec students assessed in French rank eighth. In the combined score, Québec students rank seventh in this reading assessment.

**Table 12 Comparison of reading mean scores and confidence interval, by jurisdiction and language of instruction**

| **Mean score by language of instruction** | **Combined score** | | **French, language of instruction** | | **English, language of instruction** | |
|---|---|---|---|---|---|---|
| **Jurisdiction** | Mean score | 95% confidence interval | Mean score | 95% confidence interval | Mean score | 95% confidence interval |
| British Columbia | 499 | 3.7 | 473 | 5.1 | 499 | 3.9 |
| Alberta | 506 | 4.0 | 490 | 5.2 | 506 | 4 |
| Saskatchewan | 478 | 3.8 | 468 | 8 | 492 | 3.9 |
| Manitoba | 491 | 3.9 | 468 | 4 | 478 | 4 |
| Ontario | 515 | 3.9 | 481 | 3.7 | 517 | 5 |
| **Québec** | **481** | **3.6** | **480** | **3.6** | **492** | **5.9** |
| New Brunswick | 479 | 3.9 | 464 | 4.5 | 486 | 5.3 |
| Nova Scotia | 489 | 4.0 | 475 | 2.9 | 489 | 3.5 |
| Prince Edward Island | 481 | 9.0 | | | 482 | 10.3 |
| Newfoundland and Labrador | 486 | 5.2 | | | 486 | 5 |
| Yukon | 465 | 7.1 | | | 464 | 7.3 |
| **Canada** | **500** | **2.2** | **480** | **3.6** | **507** | **2.1** |

Note: Shaded areas indicate significant differences.

### *6.3 Comparison of science mean scores*

Québec students did not do very well on the PCAP 2010 science assessment. An insignificant difference of +4 points separates Québec students assessed in English and those assessed in French.

Taken separately, Québec students assessed in English rank fifth among the jurisdictions, whereas Québec students assessed in French rank ninth. In the combined score, Québec students rank ninth in this science assessment.

**Table 13 Comparison of science mean scores and confidence interval, by jurisdiction and language of instruction**

| **Mean score by language of instruction** | **Combined score** | | **French, language of instruction** | | **English, language of instruction** | |
|---|---|---|---|---|---|---|
| **Jurisdiction** | Mean score | 95% confidence interval | Mean score | 95% confidence interval | Mean score | 95% confidence interval |
| British Columbia | 497 | 3.4 | 496 | 5.7 | 497 | 4 |
| Alberta | 515 | 3.7 | 506 | 5.7 | 515 | 3 |
| Saskatchewan | 486 | 3.9 | 486 | 7.5 | 488 | 4 |
| Manitoba | 488 | 4.2 | 482 | 3.8 | 486 | 5 |
| Ontario | 510 | 4.1 | 497 | 3.6 | 510 | 4 |
| **Québec** | **486** | **3.8** | **486** | **3.5** | **490** | **6** |
| New Brunswick | 487 | 3.9 | 482 | 5.0 | 489 | 5 |
| Nova Scotia | 489 | 4.0 | 501 | 3.4 | 489 | 4 |
| Prince Edward Island | 493 | 10.2 | | | 493 | 11 |
| Newfoundland and Labrador | 487 | 5.8 | | | 487 | 6 |
| Yukon | 478 | 7.8 | | | 478 | 9 |
| **Canada** | **500** | **2.0** | **487** | **3.3** | **504** | **3** |

Note: Shaded areas indicate significant differences.

# 7. Conclusion

This report summarizes the performance of Secondary II students in Québec and Grade 8 students elsewhere in Canada in the second PCAP Mathematics, Science and Reading Assessment (2010). Mathematics was the main component of the assessment, while reading and science were minor components.

In Québec, there was a 9-point difference in the mathematics performance of students assessed in French and those assessed in English, in favour of the students assessed in French. However, these two populations had mean scores above or equal to the mean scores in all the other jurisdictions in Canada.

In Québec, male students outperformed female students by 10 points. Also, more males demonstrated higher level mathematics skills and knowledge. The percentage of males achieving level 3 and above was higher than that of female students.

In this second edition of PCAP 2010, which was designed for Secondary II students rather than 13-year-old students, the fourth cohort of Québec students schooled under the education reform demonstrated results that once again confirm the high achievement of Québec students in mathematics and the drop in ranking in science and reading in comparison with other participating jurisdictions.

*Éducation,*
*Loisir et Sport*
Québec