Chapter 8: The Pan-Canadian Assessment Program

During 2013, over 32,000 Grade 8 students across Canada took part in the Pan-Canadian Assessment Program (PCAP). This chapter will provide an overview of how the 1,648 students from Newfoundland and Labrador performed in the three areas assessed: reading, mathematics and science. Information in this chapter was obtained from *PCAP- 2013* – *Contextual Report on student Achievement in Science* published by the Council of Ministers of Education. This report can be viewed at http:// www.cmec.ca/240/Programs-and-Initiatives/ Assessment/Pan-Canadian-Assessment-Program-%28PCAP%29/Overview/index.html

What is the PCAP?

PCAP was created by the Council of Ministers of Education, Canada (CMEC) to assess the performance of Grade 8 students in three core subject areas: reading, mathematics and science. Since the PCAP assessment is not tied to any specific provincial or territorial curriculum, it can be considered to be a fair measurement of a student's ability to use his/her learning skills to solve real-life situations.



PCAP is administered once every three years with each cycle assessing one major domain and two minor domains. Table 8.1 shows the actual and proposed domains for the PCAP administrations between 2007 and 2022.

Administration Year	Major domain	Minor domain	Minor Domain
2007	Reading	Mathematics	Science
2010	Mathematics	Science	Reading
2013	Science	Reading	Mathematics
2016	Reading	Mathematics	Science
2019	Mathematics	Science	Reading
2022	Science	Reading	Mathematics

Table 8.1: Major and minor domains assessed during PCAP

(O'Grady & Houme, 2014, p. 2)

For the 2013 administration, science was the major subject assessed. This meant science was broken down into four subdomains (nature of science, life science, physical science, and earth science) and three competencies (science inquiry, problem solving, and scientific reasoning). These competencies reflect the current Grade 8/ Secondary II science curricula for students in Canadian jurisdictions, as well as the foundation statements in the Common Framework of Science Learning Outcomes, K to 12: Pan-Canadian Protocol for Collaboration on School Curriculum (CMEC, 1997, cited in O'Grady & Houme, 2014, p. 7). The PCAP also assessed attitudes toward science to determine student interest in pursuing careers in that field.



Reporting student performance

There are two performance measures used to report assessment results: Average (or mean) scores and proficiency level. The average score is determined by student performance on a series of selected response questions. In these questions, students are provided with a list of choices from which they must select a response. This includes questions such as multiple choice, check boxes, true-or-false statements, and yes/ no observations. In PCAP, the Canadian average score was set at 500 points with a standard deviation of 100. In other words, about two thirds of all the Canadian students scored between 400 and 600 points in the assessments. This standardization of the Canadian mean allows comparisons to be made across provincial jurisdictions.

The determination of significant differences in jurisdictional mean scores was based on confidence intervals. The reported average scores provide an estimate of student achievement that would have resulted if all students participated in the assessment. Since these were estimated (not exact) scores, there was some degree of error. To take the error into account, a range of scores is given for each estimated average score. This range of scores is called a confidence interval. PCAP used a 95% confidence interval, which means the actual mean score should fall between the low and high points of the range 95% of the time. In other words, a typical student's score would fall within this range of scores. The confidence intervals are represented by the following symbol I—I. If the confidence intervals overlap, it means the differences between the average scores are not statistically significant.

The second measure is the student proficiency level. This is determined on how students fare on constructed response questions. For these questions, students must

write a response to a question. Student responses can range from short phrases, to two or three sentences, to several paragraphs. Students may also be asked to create tables or graphs, sketch diagrams, or design experiments.

The proficiency level allows student performance to be ranked according to four levels of increasing difficulty. In other words, a student assessed at a proficiency level of four would be able to demonstrate a greater depth of understanding of the subject in comparison to a student assessed at level one. A complete list of the criteria for each proficiency level can be found in Appendix C. Based on current curriculum expectations in mathematics across Canada, students in Grade 8 should demonstrate a proficiency of at least 2. Students who demonstrate a proficiency level of one are performing below what is expected in Grade 8. Proficiency levels are only reported for the major domain assessed.

The science assessment

Across Canada, average scores on the science assessment ranged from 465 in Manitoba to 521 in Ontario. In Newfoundland and Labrador, the average score was 500, the same as the Canadian average score. There were only two jurisdictions where the average score was significantly higher than Newfoundland and Labrador - Alberta and Ontario. On the other hand, the average score in four provinces (Saskatchewan, Quebec, New Brunswick and Manitoba) was significantly lower (see figure 26).

Along gender lines, there were only two jurisdictions where a significant difference was found - Alberta and Saskatchewan. In Alberta, the female average score (525) was significantly higher than the male average score (516). For Saskatchewan, the male average score was significantly higher than the female (490 and 481 respectively). In Newfoundland and Labrador, both the male and female average score was 500. Table 26 in Appendix A lists both the male and female average scores across for each of the jurisdictions.





Figure 26:

Average science scores



Proficiency levels

Grade 8 students should be able to demonstrate a proficiency level of at least two (i.e., score 379 or higher). As shown in figure 27a, this was indeed the case with the percentage of students at or above level two ranging from 86% in Manitoba to 94% in Ontario and Newfoundland and Labrador.

Figure 27b reports the percentage of students for each of the four proficiency levels. Alongside Alberta, Newfoundland and Labrador had the lowest percentage of students performing below grade level (6%). In the other jurisdictions, this percentage ranged from 7% in Prince Edward Island to 15% in Manitoba. On the other hand, 8% of students in Newfoundland and Labrador achieved the highest level of proficiency (Level 4), which was the same as the Canadian average. There were only three jurisdictions with a higher percentage of students achieving this advanced level of proficiency - Alberta (12%), Ontario (10%) and British Columbia (9%). In the other jurisdictions, this percentage ranged from 4% to 6%.



Figure 27c reports the percentage of males and females at each proficiency level for both Canada and Newfoundland and Labrador. As shown, there was virtually no gender difference present. This was also the case across the country with boys and girls achieving similar proficiency levels. Table 27 in Appendix A provides the percentage of males and females at each proficiency level for all jurisdictions.



Figure 27: Student proficiency in science



(b) Percentage of students at each proficiency level

(c) Gender differences male and female proficiency levels





Science sub-domains

PCAP assessed student performance in four science sub-domains: nature of science, life science, physical science, and earth science. Students typically performed better in:

- Life science for British Columbia students,
- Nature of science for Alberta students,
- Earth science for Prince Edward Island students, and
- Both life science and earth science for Manitoba and Newfoundland and Labrador students.



Provincially, student performance was quite similar across the four sub-domains with the average scores ranging from 495 on the nature of science sub-domain to 506 on the life sciences sub-domain. There was no significant difference found between provincial and Canadian average scores (see figure 28a).

TYpically, there were no significant gender differences present within the sub-domains. In Newfoundland and Labrador, the only sub-domain with a significant gender difference was earth science, where girls outperformed boys (512 vs 500 respectively). When compared to Canadian means, females in Newfoundland and Labrador have lower achievement in physical science, and higher achievement in Earth science. There was no difference between male achievement in Newfoundland and Labrador compared to the Canadian average in either of the sub-domains (see figure 28b).









Table 8.2 compares the average scores in Newfoundland and Labrador to the rest of Canada. As shown, there were only two sub-domains where students from another jurisdiction fared significantly better. In both the nature of science and physical science sub-domains, a significantly higher average score was found in Alberta and Ontario than in Newfoundland and Labrador. Table 28 in Appendix A provides the average scores in each sub-domain.

Science sub-domain	List of provinces where the average score was:			
	Significantly higher than NL	No significant difference from NL	Significantly lower than NL	
Nature of science	Alberta Ontario	British Columbia Nova Scotia Prince Edward Island	Saskatchewan Manitoba Quebec New Brunswick	
Life science		British Columbia Alberta Ontario	Saskatchewan Manitoba Quebec New Brunswick Nova Scotia Prince Edward Island	
Physical science	Alberta Ontario	British Columbia Saskatchewan Quebec Nova Scotia Prince Edward Island	Manitoba New Brunswick	
Earth science		Alberta Ontario Nova Scotia Prince Edward Island	British Columbia Saskatchewan Manitoba Quebec New Brunswick	

Table 8.2: Significant differences in average scores

Competencies in science

PCAP defines scientific literacy as "a student's evolving competencies in understanding the nature of science using science-related attitudes, skills, and knowledge to conduct inquiries, to solve problems, and to reason scientifically in order to understand and make evidence-based decisions about science-related issues (O'Grady & Houme, 2014, p. 7). This section will discuss student performance within the three competencies - science inquiry, problem solving, and scientific reasoning.

In general, there were few significant differences in student performance in these competencies. The only two provinces where a significant difference was present was in British Columbia and Alberta.

- In British Columbia, students performed significantly better in scientific reasoning than science inquiry and problem solving, and
- In Alberta, students achieved higher scores in both science inquiry and scientific reasoning as compared to problem solving.

In Newfoundland and Labrador, there was no significant difference present in student performance on these three competencies. In other words, students performed equally well in science inquiry, problem solving, and scientific reasoning (see figure 29a).

For Canada overall, there was only one competency where girls achieved significantly higher results than boys – science inquiry (503 vs. 497 respectively). There were no significant gender differences present in Newfoundland and Labrador (see figure 29b).







The reading assessment

In PCAP 2013, reading was assessed as a minor domain. Since the assessment framework had not been changed from the original design in 2007, comparisons could be made over time. PCAP assesses the following three aspects of reading to produce a single average reading score:

- Comprehension Students understand the explicit and implicit information provided by the text. In particular they understand the vocabulary, parts, elements, and events of the text.
- (2) Interpretation Students make meaning by analyzing and synthesizing the parts/elements/ events to develop a broader perspective and/or meaning for the text. They may identify theme/ thesis and support that with references to details, events, symbols, patterns, and/or text features.
- (3) Response to text In responding, the readers engage with the text in many ways: by making personal connections between aspects of the text and their own real/vicarious/prior experiences, knowledge, values, and/or points of view; by responding emotionally to central ideas or aspects of the text; and/or by taking an evaluative stance about the quality or value of the text, possibly in relation to other texts and/or social or cultural factors.





Student performance

Average scores across Canada ranged from 469 in Manitoba to 524 in Ontario. In Newfoundland and Labrador, it was 495. There were only two provinces (Ontario and Quebec) where students achieved a significantly higher score (see figure 30a).

Newfoundland and Labrador was one of the nine jurisdictions where student performance was significantly lower that the Canadian mean. Ontario was the only jurisdiction where student performance was significantly higher than the Canadian mean. In terms of gender, females performed significantly better on the reading assessment than males. This was the case across Canada and within each of the jurisdictions. This gender gap ranged from 17 points in Newfoundland and Labrador to over 30 points in British Columbia and Alberta (see figure 30b).

Multiyear trends in student performance

Overall reading performance improved significantly in Canada between the 2010 and 2013 test administrations. Although there was no significant difference in achievement between 2007 and 2013, there was a decline in the average score between 2007 and 2010 (see figure 30c). Across the rest of Canada, there was a great deal of variation in reading performance during this time. For example, in British Columbia, Alberta, and Nova Scotia there was no significant difference among the three administrations of PCAP. On the other hand, between 2010 and 2013 there was a significant increase in reading scores for Canada overall, Ontario, Quebec, and Newfoundland and Labrador, but a significant decrease in Manitoba and New Brunswick. Student performance for each of the jurisdictions is provided in table 30c in Appendix A..



Figure 30: Reading assessments

(b)

(C)

Gender differences in reading performance

Change over time (2007 - 2013)



■ Male ■ Female



2007 2010 2013

⁽Source: Table 30)



The mathematics assessment

In PCAP 2013, mathematics was assessed as a minor domain. Since the assessment framework that defined mathematics had not changed between the 2010 and 2013 test administrations, comparisons could be made over time between these two years.

PCAP broadly defines mathematics as a conceptual tool students can use to increase their capacity to calculate, describe, and solve problems. The domain is divided into the following sub-domains and processes. The four sub-domains include:

- (1) *Numbers and operations* Properties, equivalent representations, and magnitude;
- (2) *Geometry and measurement* Properties of 2-D figures and 3-D shapes, relative position, transformations, and measurement;
- (3) *Patterns and relationships* Patterns and algebraic expressions, linear relations, and equations; and
- (4) *Data management and probability* Data collection and analysis, experimental and theoretical probability.

In addition, there were five processes assessed - problem solving, communication, representation, reasoning, and proof and connections.

Student performance

Average scores across Canada ranged from 471 in Manitoba to 527 in Quebec. In Newfoundland and Labrador the average score was 487 which was significantly lower than the Canadian average score (507). There were six other jurisdictions with average scores significantly below the Canadian average (British Columbia, Saskatchewan, Manitoba, New Brunswick, Nova Scotia, Prince Edward Island) and one (Quebec) where it was significantly higher. In relation to Newfoundland and Labrador, there were three provinces (Quebec, Ontario and Alberta) where students achieved a significantly higher score and one (Prince Edward Island) with a significantly lower average score (see figure 31a).

There was little difference in the performance of males and females on the mathematics assessment. This was true for the overall Canadian average and each jurisdiction including Newfoundland and Labrador (see figure 31b). The only significant difference found was in Prince Edward Island, where girls outperformed boys by 13 points in mathematics (average scores were 498 vs 487 respectively).

Multiyear trends in student performance

Student performance in mathematics improved in Canada. The Canadian average score increased significantly from 500 in 2010 to 507 in 2013 (see figure 31c). There were seven jurisdictions where a significant positive change occurred in student performance. In Newfoundland and Labrador, average scores increased significantly from 472 in 2010 to 487 in 2013. In Manitoba, Ontario, and New Brunswick, average scores remained about the same during these two years. Student performance in each jurisdiction for 2010 and 2013 is provided in table 31c in Appendix A..

Figure 31: Mathematics assessment









Male Female

(c) Change over time (2010 – 2013)

73



(Source: Table 31)

