## CHAPTER 4: THE MATHEMATICS CRT

## Primary Level (Grade 3)

During the primary grades, children begin to develop the specific skills and strategies necessary for mathematical problem solving. These skills form the foundation older students build upon as they learn about numbers, mathematical operations, geometric concepts, spatial relations, measurement processes, and basic statistical techniques.

The primary level mathematics CRT is made up of two sections. In the first section, students complete constructed response questions to assess their ability to reason, communicate and solve problems. The second section assesses four strands of mathematics:

- Number operations - the ability of students to add, subtract, multiply and divide, as well as create and solve problems with these four operations;
- Number concepts - knowledge of number sense and place value. For example, a student's ability to compare and order whole numbers to thousands, estimate the size of numbers to the nearest ten or hundred, etc.,
- Shape and space - knowledge in measurement and geometry; and
- Mental math - the ability to perform mathematics mentally.



## The constructed response section (2010/11)

Grade 3 students completed a series of constructed response questions to assess their ability in number operations. These questions are grouped into four components - reasoning, communication, connections and representations, and problem solving. Provincially, students experienced the most success on the problem solving component where $77.1 \%$ of students were assessed at or above grade level. In the other three components, this percentage ranged from $60.5 \%$ in communication to $65.3 \%$ in connections and representations.

With the exception of the Nova Central School District, the percentage of students at or above grade level was fairly consistent across the four districts with between 2.0 and 5.0 percentage points separating the highest and lowest percentage. Nova Central had the highest percentage of students at or above grade level in each of the four components. The largest differences were found in the reasoning and communications components. The percentage of students at or above grade level in the Nova Central School District was 10.0 percentage points higher than the other districts (see figure 4.1a).

Girls typically outperformed boys on the constructed response section. In each of the four components, a higher percentage of girls was assessed at or above grade level than boys. This gender difference ranged from a low of 6.0 percentage points on the problem solving component to 12.6 percentage points on the reasoning component (see figure 4.1b).

Figure 4.1: Proficiency level - Primary mathematics CRT (2010/11)

(a) District and Provincial Performance
(b) Gender Differences
$\square$ Female $\square$ Male
(Source: Table 4.1)


## The multiple choice and written response sections (2010/11)

The multiple choice questions assessed student ability in number concepts, number operations, shape and space and mental math. Provincially, students experienced the most difficulty on the mental math component. The average score was approximately 10.0 percentage points lower than the other three components.

At the district level, a slightly higher average score was found in the Nova Central School District in each of the four components. With the exception of shape and space, the average score was at least 3.0 percentage points higher than the other districts (see figure 4.2a).

There was virtually no gender difference present between the female and male average score in each component (see figure 4.2b).

Figure 4.2: Average score - Primary mathematics CRT (2010/11)
(a) District and Provincial Performance

$\square$ Labrador $\square$ Western $\square$ Nova Central $\square$ Eastern $\square$ Province
(b) Gender Differences

(Source: Table 4.2)

## Provincial trends - Primary level mathematics (2006/07-2010/11)

Figure 4.3 presents the five year trends for the constructed response as well as the multiple choice and written sections. As shown, the percentage of students at or above grade level in each of the four components:

- Experienced a general upward trend since 2006/07;
- Increased dramatically (by at least 22 percentage points) between 2006/07 and 2007/08; and
- Was similar between $2009 / 10$ and $2010 / 11$ in all sections except problem solving where the percentage of students at or above grade level increased by 8.8 percentage points.

The average score on the multiple choice and timed sections was more stable over the past five years in both the number concepts and shape and space components with approximately 7.0 percentage points separating the highest and lowest scores. With the exception of 2008/09, only 2.7 percentage points separated the high and low scores on the number operations section (see figure 4.3b). The mental math section on the 2010/11 CRT was not present in the previous CRTs.

Figure 4.3: Provincial trends - Primary mathematics CRT (2006/07-2010/11)

(a) Contructed Response

■ 2006/07 ■ 2007/08 - 2008/09 - 2009/10 ■ 2010/11
(b) Multiple Choice and Timed Sections

## Elementary Level (Grade 6)

During the elementary years, the mathematics curriculum is designed to help students further develop and strengthen specific skills and strategies for mathematical problem solving. These skills and strategies are applied as part of the development of basic geometric concepts, spatial relations, measurement processes, and basic statistical techniques. The elementary CRT assessment is composed of multiple-choice and constructed response questions in four strands of mathematics - number concepts, number operations, shape and space, and mental mathematics.

## The constructed response section (2010/11)

Grade 6 students completed a series of constructed response questions to assess proficiency in number operations. These questions can be grouped into four components - reasoning, communication, connections and representations, and problem solving.

Provincially, students experienced the most success on the problem solving component where $68.1 \%$ were assessed at or above grade level. Students experienced difficulty on both the communication and the connections and representations components. In each of these, less than half of the students were assessed at or above grade level.

At the district level, students experienced the most success on the problem solving component and the greatest difficulty on the connections and representations component (see figure 4.4a).

Females outperformed their male counterparts in each of the four components assessed. The difference between the percentage of female and male students at or above grade level ranged from 14.6 percentage points on the problem solving component to 20.6 percentage points on the communication component (see figure 4.4b).


Figure 4.4: Proficiency level - Elementary mathematics CRT (2010/11)


## The multiple choice and written response sections (2010/11)

The multiple choice questions assessed student ability in number concepts, number operations, patterns and relations, shape and space and mental math. Provincially, higher average scores were seen on the number concepts, number operations and shape and space components as compared to the patterns and relations, and mental math components.

A consistent average score was seen in each component across the four districts with between 2.0 and 4.0 percentage points separating the highest and lowest score (see figure 4.5a).

The average score of females on each of the components was higher than the males. This gender difference ranged from 1.7 percentage points in the shape and space component to 5.9 percentage points in number operations (see figure $4.5 b$ ).

Figure 4.5: Average score - Elementary mathematics CRT (2010/11)
(a) District and Provincial Performance


- Labrador $\square$ Western $\square$ Nova Central $\square$ Eastern ■ Province
(b) Gender Differences



## Provincial trends - Elementary level mathematics (2006/07-2010/11)

Figure 4.6 tracks student performance on both the constructed response and multiple choice/ written response sections over the past five years. On the constructed response section, the percentage of students at or above grade level:

- Was higher on the problem solving component as compared to the others. This was the only area where a general upward trend was seen.
- Followed a similar pattern in the reasoning and communication components, where the percentage of students at or above grade level was lowest during 2006/07 and 2008/09. The percentage for these two years was approximately 15.0 percentage points lower than the other years.

Between 2009/10 and 2010/11, the percentage of students at or above grade level declined in reasoning, communication and the connections and representations components. The only increase occurred in the problem solving component where the percentage increased by 10.3 points.

On the multiple choice and written response sections:

- The 2010/11 average score declined from 2009/10 in three of the four components. This decrease ranged from 5.0 percentage points on the number operations and shape and space components to 10.0 percentage points on the number concepts component. In the mental math section, the average score increased by 5.5 percentage points.
- A general decline occurred on the number operations component with the average scores decreasing each year between 2007/08 and 2010/11.


Figure 4.6: Provincial trends - Elementary mathematics CRT (2006/07-2010/11)
(a) Constructed Response


- 2006/07 - 2007/08 - 2008/09 - 2009/10 ■ 2010/11
(b) Multiple Choice and Written Response


ㅁ 2006/07 - 2007/08 ㅁ 2008/09 2009/10 ■ 2010/11
(Source: Table 4.6)


## Intermediate Level (Grade 9)

During the intermediate years, students continue to develop and practice the specific skills and strategies necessary for mathematical problem solving. These skills and strategies are applied as part of the consolidation of the concepts and skills of the real number system and measurement, and the development of introductory algebra, informal geometry and basic descriptive statistics.

The intermediate mathematics CRT assesses four strands of the curriculum: numbers, patterns and relations, shape and space, and statistics and probability. Specifically, it assesses each student's ability to:

- Demonstrate number sense and apply numbertheory concepts,
- Use patterns to solve problems,
- Represent algebraic expressions in multiple ways,
- Use measurement to solve problems,
- Describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them,
- Describe and analyze position and motion of objects and shapes,
- Collect and analyze data to solve problems, and
- Use experimental or theoretical probabilities to represent and solve problems involving uncertainty.

The CRT is made up of two sections. The first includes a series of selected response questions. These are multiplechoice questions where students are asked to select the correct response. The second section is composed of constructed response questions where students are expected to write or draw an answer to the question.


## The multiple choice and constructed response sections (2010/11)

Provincially, students experienced the most success on the statistics and probability section where the average score was at least 13.0 percentage points higher than the other components. At the district level, between 6.0 and 8.0 percentage points separated the highest and lowest average scores in each component (see figure 4.7a).

Females had slightly higher average scores than males in each of the four components. This gender difference ranged from 0.9 percentage points for statistics and probability to 4.6 percentage points for the numbers component (see figure 4.7b).

Figure 4.7: Average score - Intermediate mathematics CRT (2010/11)

(a) District and Provincial Performance
$\square$ Labrador $\square$ Western $\square$ Nova Central $\square$ Eastern $\square$ Province
(b) Gender Differences
(Source: Table 4.7)

