EQAO

# Student Achievement on Mathematics Curriculum Strands, 2021–2022

## Research Brief

OCTOBER 2023

What are Ontario students' strengths and needs in mathematics? How does achievement on curriculum strands relate to meeting overall curriculum expectations? EQAO took a look at these questions using the 2021–2022 mathematics curriculum strand results for Grade 3, Grade 6 and Grade 9 students across Ontario.

To explore these questions, the following analytic strategies were used:[1]

1. The average percentage correct for each strand was calculated for each grade.
2. The correlations between percentage correct scores for each strand were calculated for each grade.
3. A "benchmark" percentage correct for each strand was set for each grade. The benchmark percentage correct was the score achieved by 80% of students who achieved Level 3, the provincial standard for achievement. Readers can think of the benchmark percentage correct as the minimum score a student needs to have a good chance of meeting provincial expectations.[2]
4. The percentage of students who achieved Level 2 (approaching the provincial standard) **and** achieved the benchmark percentage correct was calculated for each strand and grade.

All students in Ontario who wrote the adaptive online version of the mathematics components of the primary- and junior-division assessments or the adaptive online Grade 9 Assessment of Mathematics and were provided an achievement level were included in the analysis. Therefore, the data set included 126 660 Grade 3 students, 130 711 Grade 6 students and 72 616 Grade 9 students.[3] Student scores from English-language and French-language boards were analyzed together, because there were no meaningful differences between the populations.[4]

[1] Reference full research report to see results (EQAO, 2023a, 2023b).

[2] The technical term for this score is the 20th percentile score. The 20th percentile was chosen because it is a quantified way of saying "a large majority of students who achieved Level 3 can achieve this percentage correct."

[3] During the 2021–2022 school year, many school boards were not able to administer the Grade 9 mathematics assessment in January, due to the pandemic, so this cohort size is smaller than in previous and subsequent years.

[4] Student scores from English-language and French-language boards were initially analyzed separately, but the results presented in this research brief were the same for all strands.

## Average mathematics achievement

Looking at the average achievement on each strand gives us an idea of how many questions students answer correctly on average.[5] Table 1 shows the average achievement for each strand and grade. Results show, for example, that at each grade level, students answer fewer questions correctly on average in the Spatial Sense/Geometry and Measurement strand than they do in the Number strand.

**Table 1. Average percentage correct for all students, by strand and grade**

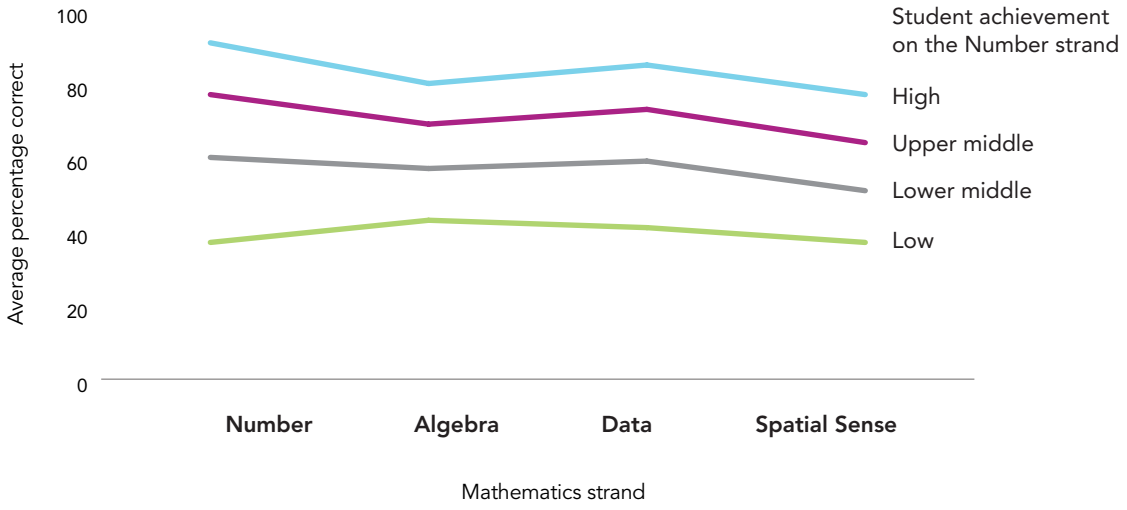
| Curriculum strand | Grade 3 | Grade 6 | Grade 9 |
|---|---|---|---|
| **Number** | 65.8 | 62.3 | 61.8 |
| **Algebra** | 62.0 | 60.9 | 50.9 |
| **Data** | 63.8 | 53.3 | 58.2 |
| **Spatial Sense/Geometry and Measurement** | 56.8 | 52.5 | 52.5 |
| **Financial Literacy** | NA | 75.5 | 72.0 |
| **Total number of students** | 126 660 | 130 711 | 72 616 |

## Mathematics learning overflows across the strands

In addition, an important finding from the analysis is that students answering many questions correctly in one mathematics strand usually also answered many questions correctly in other mathematics strands. For example, Figure 1 shows that, on average, although the exact numbers vary, Grade 3 students who answered many questions correctly on the Number strand also answered more questions correctly than other students in Algebra, Data and Spatial Sense.

This finding makes clear that achievement among the mathematics curriculum strands is highly connected, meaning that student understanding in one strand "overflows" and makes it easier to understand concepts in other strands. We might ask, however, whether there are some strands that exert more influence on achieving overall curriculum expectations than others. For example, does it matter whether equal emphasis is given to all strands, or do some strands require more emphasis?

**Figure 1. Average percentage correct on each mathematics strand among four groups of Grade 3 students**




[5] The percentage correct across strands cannot be compared as evidence that students have achieved higher or lower in a particular curriculum strand, because the assessments are not designed to contain questions of the same overall difficulty for each strand. For example, while Grade 9 students on average answered 51% of Algebra questions correctly and 62% of Number questions correctly, it could just be that the Number strands had some easier questions than the Algebra strand. As a result, for students to meet provincial expectations, we should also not expect the same percentage correct to be required for all strands.

## Some strands appear to exert more influence than others

We introduced the benchmark percentage correct on page 1. Remember, 80% of students who achieved Level 3, the provincial standard, achieved this percentage. Let's now look at the percentage of students who achieved Level 2 and achieved the benchmark percentage correct on each strand.

The findings, shown in Figure 2, are striking. For example,

- only 9% of students in Grade 3 who achieved Level 2 also achieved the benchmark percentage correct (i.e., the percentage that 80% of students at Level 3 obtained) for the Number strand.
- In Grade 6, 12% of students at Level 2 achieved this percentage.
- In Grade 9, the percentage was a little higher: 24% of students at Level 2.

At the same time, within each grade, the strands show different patterns for these percentages. Looking at these patterns, backed up with a review of curriculum content and the number of assessment questions devoted to each strand, we see that some strands appear to exert more influence on meeting overall curriculum expectations than others in certain grades.

**Figure 2. Percentage of students who achieved the benchmark percentage correct for each strand by level**

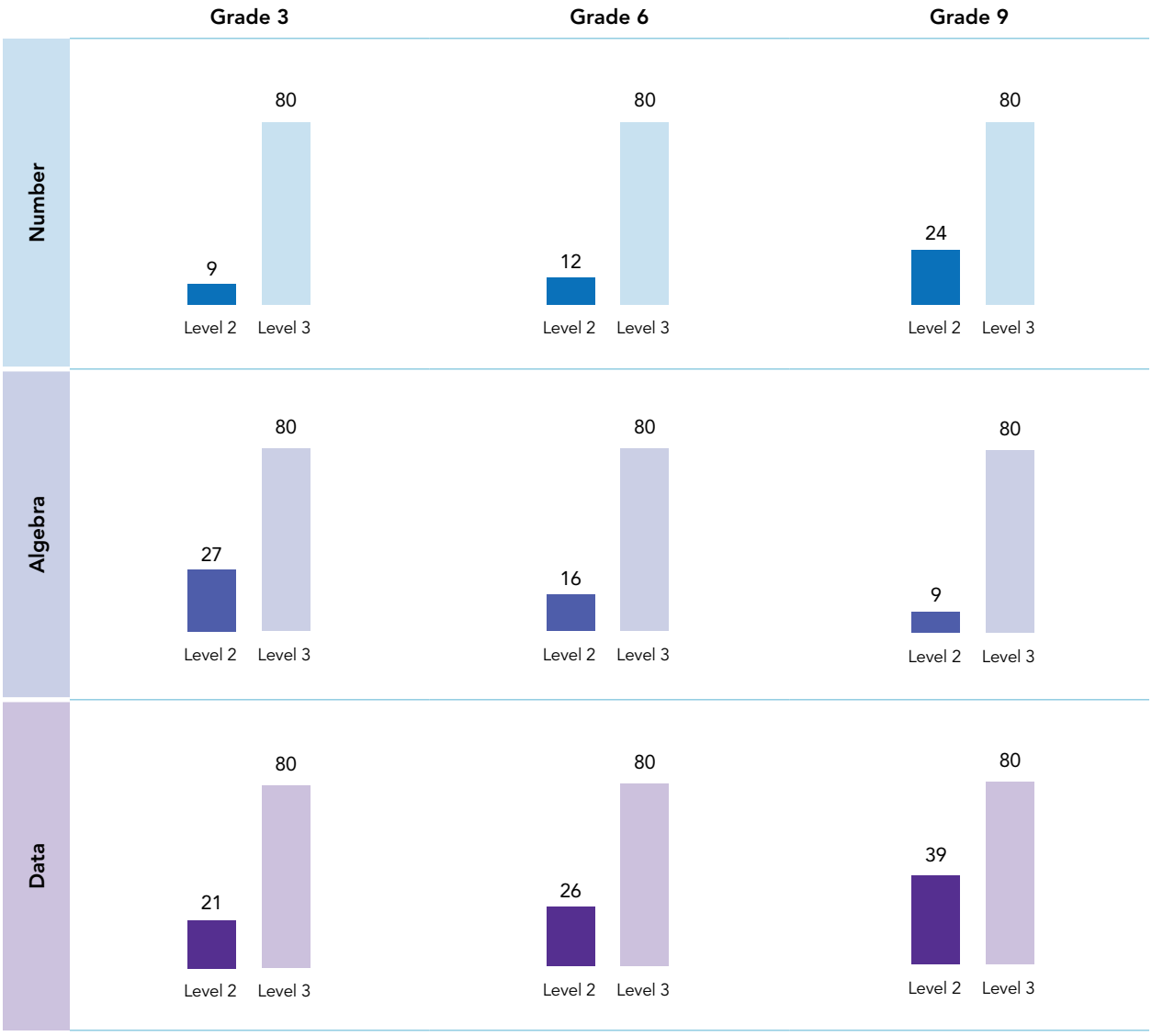
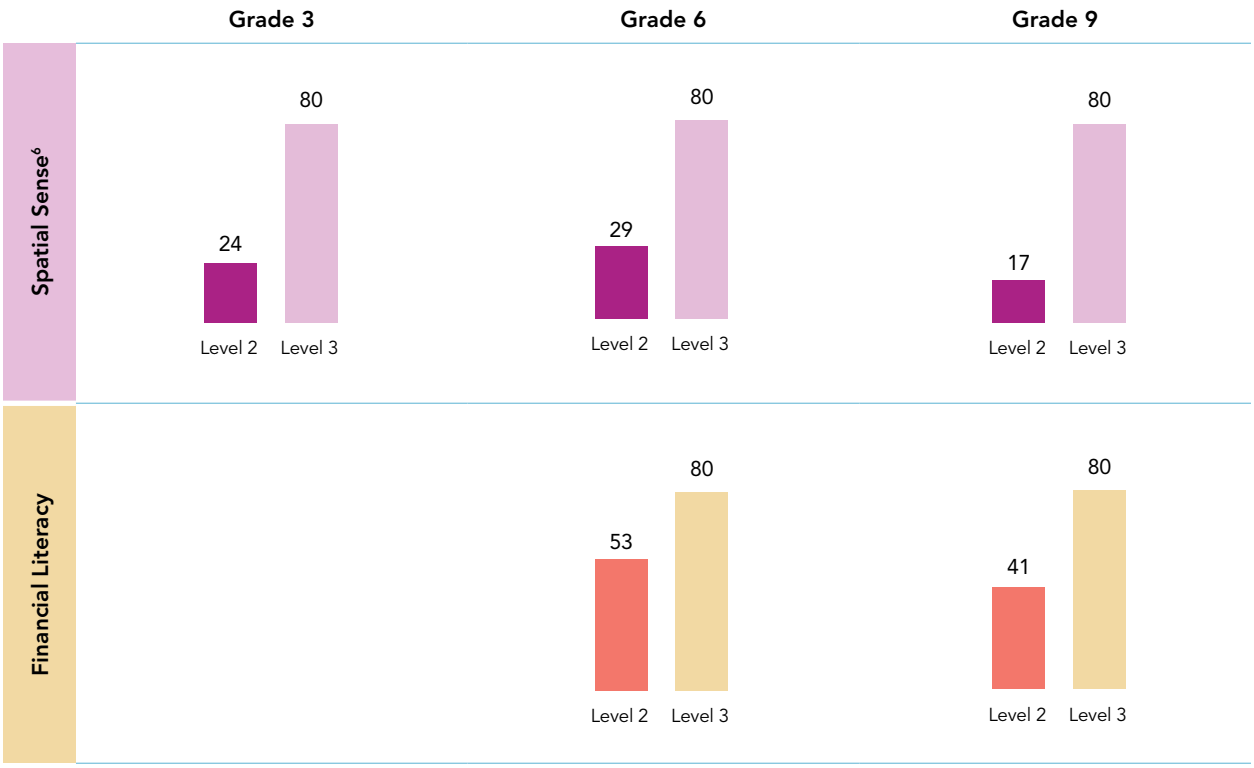


**Figure 2 (continued). Percentage of students who achieved the benchmark percentage correct for each strand by level**




## Which strands relate most closely to meeting overall curriculum expectations?

### Number is foundational at all grade levels.

Firstly, the Number strand appears critical for meeting provincial expectations, particularly in Grade 3. Although Number becomes less critical as the curriculum progresses from Grade 3 to Grade 6 to Grade 9, it remains foundational. As outlined above, only 9% of Grade 3 students who achieved Level 2 also achieved the benchmark percentage correct for Number. By Grade 6, 12% of students at Level 2 met the benchmark. By Grade 9, 24% of students at Level 2 met the benchmark.

### Algebra is critical to keeping up with grade-level expectations.

In contrast, as students progress in mathematics, developing abilities in Algebra appears to become increasingly critical to meeting grade-level expectations. By Grade 9, students who do not yet grasp key Algebra concepts may be unable to meet the provincial standard. For example, in Grade 3, 27% of students who achieved Level 2 were able to meet the benchmark percentage correct in Algebra. In Grade 6, 16% were able to meet the benchmark. By Grade 9, only 9% achieved the benchmark.

[6] In Grade 9, this strand is called "Geometry and Measurement."

**Geometry and Measurement builds on Algebra.**
Unique to Grade 9, Geometry and Measurement appears particularly important to meeting overall expectations for this grade. This may be because Geometry and Measurement at Grade 9 uses concepts and skills from the Algebra strand, once again demonstrating that algebraic concepts are critical to the growth of students' mathematics ability. For example, in Grade 3, 24% of students who achieved Level 2 met the benchmark percentage correct. By Grade 6, 29% of students met the benchmark. At Grade 9, only 17% of students met the benchmark.

**Data strand learning is focused in the primary and junior grades.**
In Grades 3 and 6, Data curriculum expectations appear relatively challenging to meet if students have not demonstrated proficiency in grade-level expectations overall. However, expectations in the Data strand at Grade 9 include concepts that can often be grasped by students who do not demonstrate proficiency in the overall Grade 9 math curriculum expectations. For example, in Grade 3, 21% of students who achieved Level 2 could meet the benchmark percentage correct for Data. In Grade 6, 26% of students could meet the Data benchmark. By Grade 9, 39% of students achieved the benchmark.

**Financial Literacy requires different knowledge.**
Finally, curriculum expectations for Financial Literacy focus on logical thinking, knowledge of daily financial tasks and deductive reasoning. Many students who are still working on key grade-level math abilities such as numeracy, algebraic thinking and abstract mathematical concepts show knowledge of these skills. For example, 53% of Grade 6 students who achieved Level 2 met the benchmark percentage correct. Similarly, at Grade 9, 41% of students met the benchmark.[7]

## Implications for teaching

These findings show that it is essential to address all curriculum strands, as mathematical thinking and skills are highly connected. Educators may therefore choose to integrate the curriculum strands through a planning model that permits them to intentionally integrate different concepts and strands (e.g., the spiral approach or interleaving) in the classroom throughout the school year. In this way, educators can gradually and systematically introduce more complex and rigorous tasks, and the progression of learning will become more complex both as the school year progresses and from grade to grade.

In addition, the findings imply that the following strategies are important for student success:

- In Grades 1 to 3, treat the Number strand as a key strand in the primary curriculum because it covers many foundational mathematical concepts. Focusing on related Number concepts in kindergarten is likely also important.
- In Grades 4 to 6, ensure that the integration of strands positions curriculum expectations from the Number and Algebra strands so that students are set up for success when learning concepts from Data and Spatial Sense strands. For Financial Literacy, it is recommended that educators ensure students can use language related to daily finances.
- In Grades 7 to 9, treat the Algebra strand as a key strand in the intermediate and Grade 9 curricula, as students develop their mathematics skills toward increasingly advanced, abstract mathematical concepts.

[7] The large overlap is also likely related to the small number of questions given to Financial Literacy on the assessments.

A detailed discussion of implications for teaching is available in Student Achievement on Mathematics Curriculum Strands, 2021–2022: Implications for Instructional Planning (2023).

## References

EQAO. (2023a). *Student achievement on mathematics curriculum strands: Results from the 2021–2022 Grades 3, 6 and 9 assessments.* King's Printer for Ontario.

EQAO. (2023b). *Student achievement on mathematics curriculum strands, 2021–2022: Implications for instructional planning.* King's Printer for Ontario.