

Education Quality and
Accountability Office



#DataInAction Math Superpowers

Presented at the American Educational Research
Association annual meeting

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#DataInAction—Math Superpowers

THE INQUIRY

Is mathematics achievement all about the math, or can students advance their math achievement by empowering themselves as math students? EQAO research suggests that positive attitudes and strategies support success.

PARTICIPANTS

The inquiry considered 100 370 Ontario students (50 321 boys, 50 049 girls) attending publicly funded schools who completed the Grade 3 Student Questionnaire and who had EQAO math assessment results in primary, junior and Grade 9. Math results for Grade 3 (2008–2009), Grade 6 (2011–2012) and Grade 9 (2014–2015) were linked. Students studying in English- and French-language school boards were included.

MEASUREMENT

Responding to statements contained in Table 1, at the end of the Grade 3 assessment, students rated themselves on their attitude toward math and on their use of math strategies using a three-point scale (low, moderate and high). These ratings were used to assign students to one of three groups for Math Attitude (low positive, moderately positive, highly positive). Similarly, the ratings were used to assign students to one of three groups for their use of math strategies (low use, moderate use and high use). Group assignment was established in Grade 3 and remained stable across Grades 3, 6 and 9.

Table 1. Questionnaire Items Associated with Math Strategies and Attitude Toward Math

Student Questionnaire Items
Superpower 1: Attitude Toward Math
1. I am good at mathematics.
2. I like mathematics.
3. I am able to answer difficult mathematics questions.
Superpower 2: Math Strategies
1. I do my best when I do mathematics activities in class.
2. I think about the steps I will use to solve the problem.
3. I read over the problem first to make sure I know what I am supposed to do.

Note: Items within superpowers are more closely related to one another than they are to items in another superpower—EQAO checked the math.

Achievement scores are the raw scores that underlie the achievement levels reported in provincial reporting.¹

¹ Raw scores range from 0.1 to 4.9.

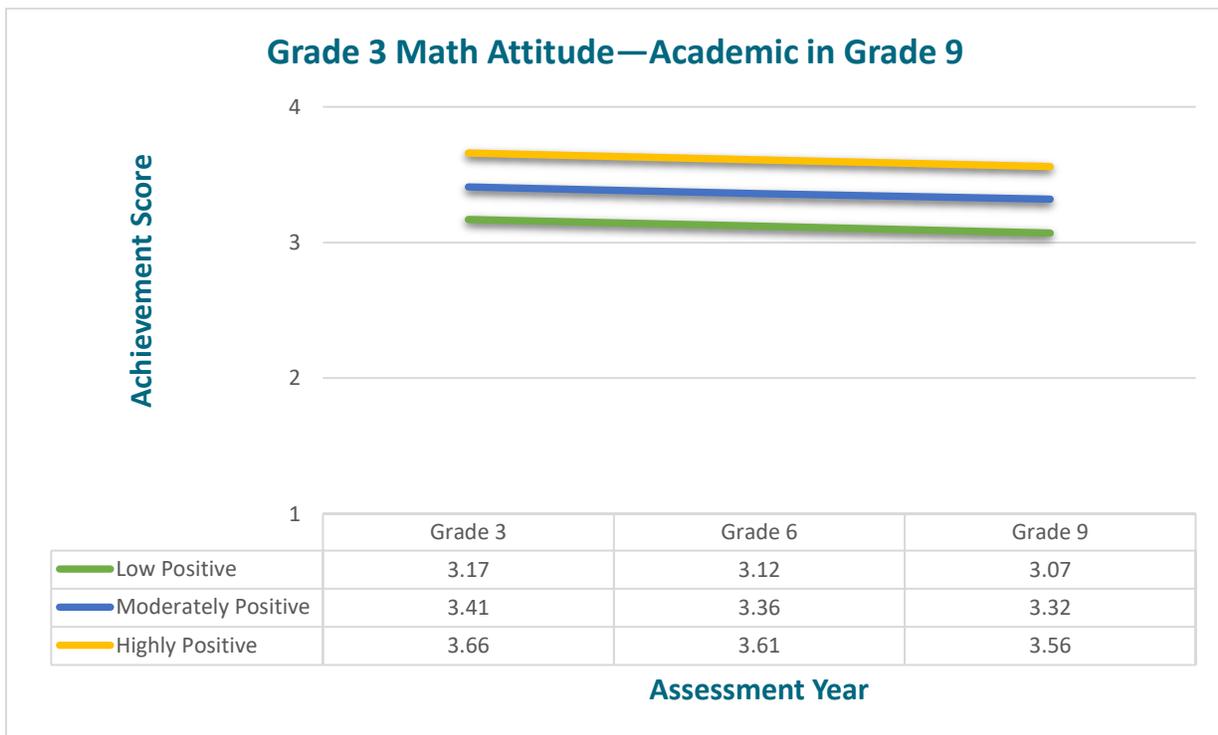
SUPERPOWER 1: MATH ATTITUDE

Students who study in the academic math program in Grade 9 rated themselves as having moderate to high positivity toward mathematics in Grade 3—a finding that is true for both boys and girls (see Table 2). Figure 1 illustrates that higher academic math achievement in Grade 9 is associated with positive attitudes toward math in Grade 3.

Table 2. Frequency of Grade 3 Math Attitude by Gender—Academic Math Program in Grade 9

Math Attitude in Grade 3	Boys	Girls	Total
Low Positive (1)	1 476	1 537	3 013
Moderately Positive (2)	16 089	20 660	36 749
Highly Positive (3)	18 867	16 806	35 673
Total	36 432	39 003	75 435

Figure 1. Math Attitude in Grade 3 by Achievement Scores in Grade 9 Math—Academic



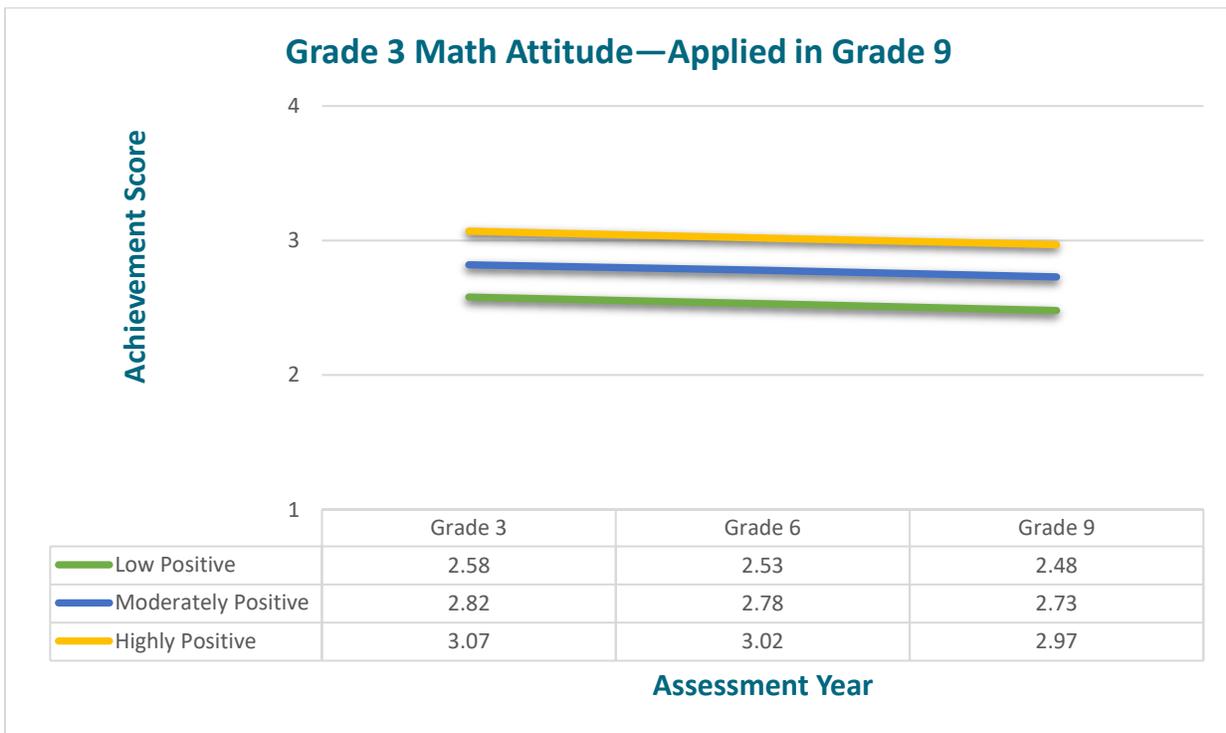
Students who study in the applied math program in Grade 9 most often rated themselves as having moderately positive attitudes toward mathematics in Grade 3—a finding that is true for both boys and girls (see Table 3). As was the case with the students in the academic program, in the applied program, higher math achievement in Grade 9 is associated with positive attitudes toward math in Grade 3 (see Figure 2).

It is noteworthy that only students rating themselves as having highly positive attitudes demonstrated achievement that met provincial standards.

Table 3. Frequency of Grade 3 Math Attitude by Gender—Applied Math Program in Grade 9

Math Attitude in Grade 3	Boys	Girls	Total
Low Positive (1)	1 637	1 163	2 800
Moderately Positive (2)	7 680	6 723	14 403
Highly Positive (3)	4 572	3 160	7 732
Total	13 889	11 046	24 935

Figure 2. Math Attitude in Grade 3 by Achievement Scores in Grade 9 Math—Academic



Taken together, the results highlight that a positive attitude toward math in Grade 3 is likely to lead to higher achievement. And the more positive the attitude in Grade 3, the better the score through the transition to high school. This is true for both programs of study (i.e., academic and applied) and for both boys and girls.

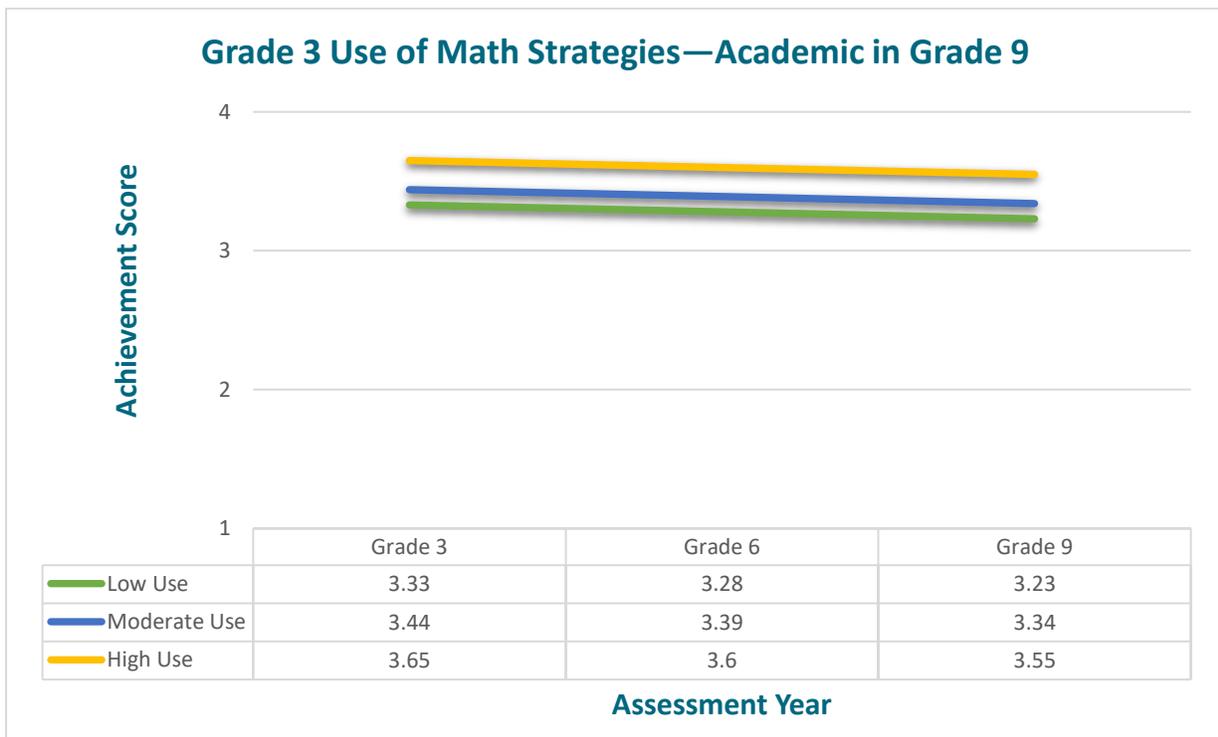
SUPERPOWER 2: USE OF MATH STRATEGIES

Most often, students who study within the academic math program in Grade 9 rated themselves as having low to moderate use of strategies in Grade 3, which is true for both boys and girls (see Table 4). As was the case with Math Attitude, higher use of strategies forecasts higher achievement scores in Grade 9 (see Figure 3).

Table 4. Frequency of Grade 3 Use of Math Strategies by Gender—Academic Math Program in Grade 9

Math Strategies in Grade 3	Boys	Girls	Total
Low Use (1)	15 529	11 133	26 662
Moderate Use (2)	19 115	26 106	45 221
High Use (3)	1 788	1 764	3 552
Total	36 432	39 003	75 435

Figure 3. Use of Math Strategies in Grade 3 by Achievement Scores in Grade 9 Math—Academic

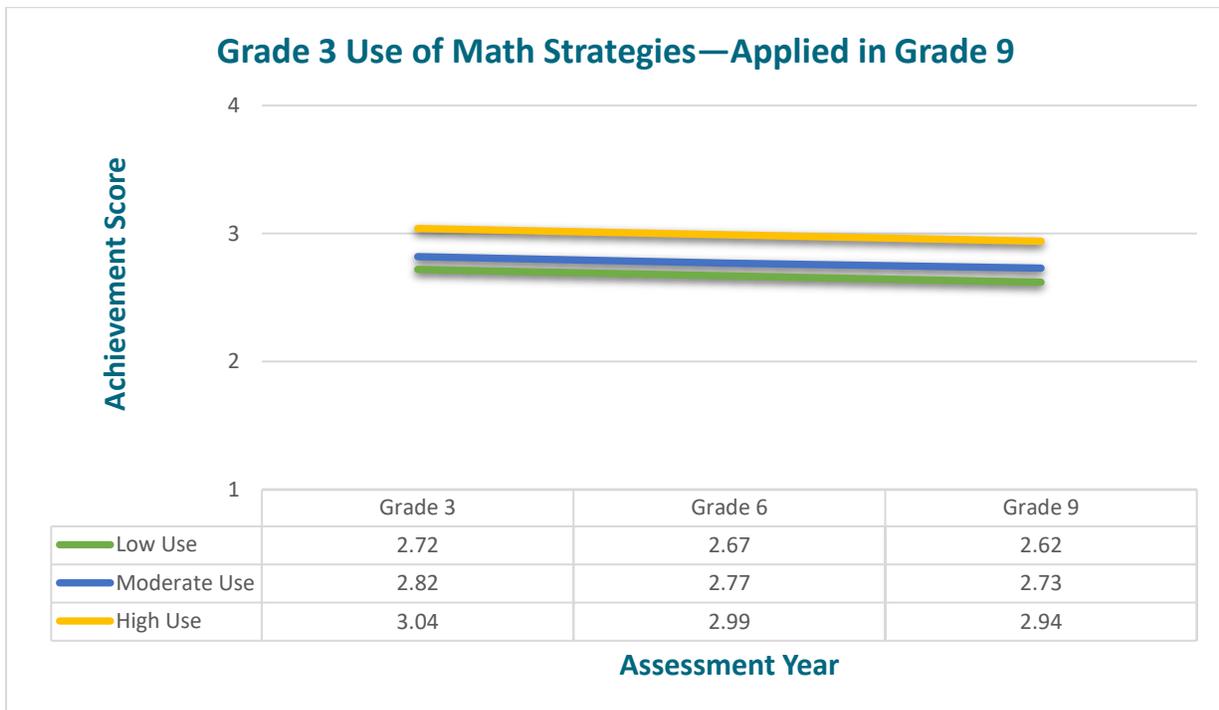


Students who study in the applied math program in Grade 9 most often rated themselves as low users of math strategies in Grade 3 (see Table 5). As was the case with the students in the academic program, in the applied program, higher math achievement in Grade 9 is associated with high usage of math strategies in Grade 3 (see Figure 4). And, similarly to the case with math attitude, only students rating themselves as high users of strategies demonstrated achievement that met provincial standards.

Table 5. Frequency of Grade 3 Use of Math Strategies by Gender—Applied Math Program in Grade 9

Math Strategies in Grade 3	Boys	Girls	Total
Low Use (1)	8 679	7 939	16 618
Moderate Use (2)	4 797	2 831	7 628
High Use (3)	413	276	689
Total	13 889	11 046	24 935

Figure 4. Use of Math Strategies in Grade 3 by Achievement Scores in Grade 9 Math—Applied



When Grade 3 students bring their best work, think about the steps that they need to use and clarify the question, their scores will reflect their actions. The use of these simple and teachable strategies in primary has effects lasting into high school.

CONCLUSION

Success in mathematics is about math, yet this #DataInAction research suggests that there is more to math achievement than the numbers. Developing a positive attitude and using math strategies early have long-term payoffs; they empower students toward greater success.

So, to all Grade 3 students:

1. Choose a positive attitude for math. You can be good at mathematics; you can like math; and you will learn to answer difficult math questions.
2. Bring your best efforts to the math activities you do at school. Think about the steps you use to solve math problems.
3. Practise reading over the problem first to make sure you know what you are supposed to do. Sometimes math is more about the question than the answer.

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