

1.3 - Mastering Math Facts

Jennipher: We want Ontario students to master their math facts. That's what this fundamental says. We want students to understand and recall these facts by developing a variety of strategies that they can use both to learn them and to double check that their answers are reasonable.

Craig: Before we dig in, let's make sure we know what we're talking about. The expectation of the Ontario Curriculum, is that by the end of grade 2, our students should understand and recall their addition facts to 20 and use those facts to derive related subtraction facts.

Jennipher: And by the end of grade 4, students should understand and recall their multiplication facts up to 10×10 and use those multiplication facts to derive related division facts.

Craig: Notice the emphasis: We want students to *understand* and *recall*. If you look at pages 5 and 6 of the Teacher's Guide, all of the concepts and skills related to the acquisition of math facts are organized under these two verbs. It's not enough to just recall; we want students to understand the how and the why of these math facts because this builds success with the other fundamentals.

Jennipher: Exactly. But the good news is that once the fundamentals of Number Properties and Working with Numbers are in place, students are in a great position to understand and recall these facts. For example, as students learn to trust the count, they learn that there are various ways to make 8. They might visualize 8 as $4+4$, and then mentally move a counter from one side to the other to make $5+3$ and one more again to make $6+2$ and $7+1$. This all comes from their work with numbers.

Craig: Right. And as they learn to decompose numbers, the associative property enables them to master facts that cross over 10. So for example, take $7+6$. You might break 6 into $3+3$. You take one of those 3s, add it to 7 to make 10, and then add 3 more to make 13. Making 10 is one of those powerful strategies that remains very relevant as students perform other mental math calculations beyond these facts.

Jennipher: Nice point. The importance of 5 and 10 as benchmarks anchor their work with math facts. So does their work with skip counting and doubles. With math facts, such as doubles, under their belt, students can again apply the associative property with near doubles -- doubles plus 1 or

doubles less 1. But it's all built off of their work with numbers and number properties.

Craig: Now, let's turn our attention to multiplication facts. Once again our work with numbers and number properties -- plus our work with mastering the addition facts -- puts us in a great position to learn our multiplication facts to 10x10.

Jennifer: Great point. A lot of people think that you learn facts in numerical order -- start with the 1s, move on to 2s, the 3s, and so on... But it's much more effective to build on what students already know. So start with the 2, 5 and 10 facts. Twos build on students prior work with doubling. The development of fluency with skip counting by 5's and 10's, supports students to learn their 5 and 10 times tables.

Craig: Great. And their understanding of number properties helps them learn their 0 and 1 facts.

Jennifer: Often, the "square" numbers, like 7×7 , are facts that students enjoy learning and commit to memory.

Craig: And, because of the commutative property, if they know 2×8 they also know 8×2 . So that essentially cuts this chart in half.

Jennifer: So we're left with the 3s, 4s, 6s, 7s, 8s and 9s and perhaps doubles if they weren't already committed to memory. Once again, students use what they know to find out what they don't know. And so we call into action our fundamental on number properties.

Craig: For some of these facts, students can use their skip counting skills -- 3, 6, 9, 12 for example -- to learn their 3s. Others can be derived from facts that they already know. So for example, students think of their 9-facts as 10 groups less 1 group. And they think of their 6-facts as 5 groups and 1 more group. This is the distributive property in action.

Jennifer: And the associative property let's me think of 4 as double my 2 facts and 8 as a double double, if you will. And that takes care of them all. Because the 7s have been dealt with elsewhere

Craig: Over time students move to the point where these facts become quickly recalled and automatic. But this takes deliberate and focussed practice. This takes time.

Jennipher: Instead of practising all the facts at once, focus on one set of facts at a time so the practice is strategic. Then move to related facts, where students can work through strategies that connect one fact to another, like learning their 9 facts based on their understanding of their 10 facts.

Craig: But again, all this takes time. Playing games provides opportunities for students to practice and consolidate facts. And they allow teachers an opportunity to gather observations.

Jennipher: Games that include visuals and manipulatives are especially helpful as they help students build number sense and an understanding of operations. Games are also a great way to engage parents and families as well.

Craig: It is important to highlight that as students are learning their facts, especially at first, it would be helpful to eliminate any emphasis on speed, recognizing that students are still learning their basic facts.

Jennipher: Exactly. If we prioritize speed, students' math anxiety may increase which in turn may keep them from developing more sophisticated strategies. And that's a key part of this fundamental. Strategies not only help students master their facts they also reinforce the other fundamentals! So a focus on speed too early can produce unintended side effects.

Craig: You may ask, what about students who count on their fingers? This is a useful strategy especially at early stages of development, from there students should continue to develop more sophisticated strategies. And as students become more proficient with math facts, they are better able to handle more complex mathematical strategies.

Jennipher: Hey, the mastering of math facts involves understanding, recalling, practicing, and applying. And it's fundamental in supporting mathematics learning in all strands, and across all of life. So thanks for your work in helping our students master their math facts.