Learning Addition and Subtraction Facts in Second Grade

Efficient computation strategies are based, in part, on developing fluency with addition and subtraction facts. Fluency means that facts are quickly accessible mentally, either because they are immediately known or because the calculation that is used is so effortless as to be essentially automatic (in the way that some adults quickly derive one combination from another—for example, thinking $8 + 9 = 8 + 8 + 1$). In *Investigations*, the development of fluency begins in Kindergarten where students are expected to fluently add and subtract within 5. Fluency within 10 is expected in Grade 1 and within 20 by the end of Grade 2.

More Than Just "Facts"

Addition combinations and their subtraction counterparts are traditionally referred to as "the facts," and that terminology is used in this curriculum. However, "fact" often implies something that can only be memorized (such as the first president of the United States, or the capital of Nebraska) and not something that can be learned through reasoning. In *Investigations*, students learn addition and subtraction facts by using what they already know about numbers and number relationships, about the properties of addition and subtraction, and about the relationship between these two operations. Relying on memory alone is not sufficient. If students forget answers, they are left with no way to think about the problem. If, however, their learning of the facts is based on reasoning, they have a way to determine the answer.

For example, the sum of $7 + 8$ can be determined in many ways. If we forget that $7 + 8 = 15$, but understand what addition is, and know some related combinations, we can reason to find the sum. For example, if we know that $7 + 7 = 14$, we can add 1 more to get 15. If we know that $8 + 8 = 16$, we can take 1 away and get 15. If we know that $7 + 3 = 10$, we can add the 5 that's left to get 15 ($7 + 8 = 7 + 3 + 5 = 15$). In K–2, students use the facts repeatedly, in a variety of contexts, while also building an understanding of the properties of the operations, specifically the commutative and associative properties, and the relationship between addition and subtraction.

Practicing the Facts

As in K–1, students encounter many activities, games, and story problems that involve adding and subtracting within 20. In Grade 2, designated time to review and practice the facts is built into the curriculum, in sessions and as a recurring Classroom Routine, *Fact Fluency.*

Fact Cards are also introduced as a tool to support fluency as well as independent responsibility for keeping track of "Facts I Know" and "Facts I Am Still Working On." Fact Cards for addition present two related problems—except for the Doubles, which have one—building on and strengthening students' understanding of the commutative property of addition. Subtraction Cards present only one problem. While Grade 2 students come to see that $10 - 4$ and $10 - 6$ are related not only to each other but also to their addition counterparts (i.e., $4 + 6$ and $6 + 4$), they develop this understanding of the relationship between the operations of addition and subtraction over time. Because students often view these as unrelated problems early in the year, when students first get the cards, they are purposely presented on two different Fact Cards.

$$1 + 2$$
$$2 + 1$$
Clue: _____

$$2 - 1$$
Clue: _____

Over the course of the year, students receive sets of Fact Cards that represent various groups of addition and subtraction facts and sort them into two envelopes: "Facts I Know" and "Facts I Am Still Working On." In this way, students determine which facts they know and which they need to practice. After opportunities to practice, the clue line provides scaffolding for challenging facts that remain hard to remember.

In Unit 1, the fact work focuses on reviewing addition and subtraction within 10, a Grade 1 benchmark, plus a few additional facts, and on thinking about categories of facts. The focus on groups of related facts helps students learn effective strategies for finding solutions.

Fact Cards: Set 1*	Fact Cards: Set 2
Doubles	Minus Half
Plus 1	Minus 1
Plus 2	Minus 2
Make 10	10 Minus
Other $3 + 4$ and $4 + 3$ $3 + 5$ and $5 + 3$ $3 + 6$ and $6 + 3$ $4 + 5$ and $5 + 4$	Other $4 - 3$ $5 - 3, 5 - 4$ $6 - 4, 6 - 5$ $7 - 3, 7 - 4, 7 - 5, 7 - 6$ $8 - 3, 8 - 5, 8 - 6, 8 - 7$ $9 - 3, 9 - 4, 9 - 5, 9 - 6,$ $9 - 7, 9 - 8$

* **Some combinations fall into more than one category.**
For example, $1 + 9$ and $9 + 1$ is a Make 10 and a Plus 1 Fact.

Later units provide practice with these facts, and introduce and practice the remaining facts.

Fact Cards: Set 3*	Fact Cards: Set 4
Near Doubles	Plus 10
	Minus 10

Fact Cards: Set 5	Fact Cards: Sets 6 and 7
Plus 9	Remaining Facts
Minus 9	

* **Some combinations fall into more than one category.**
For example, $9+8$ and $8+9$ is a Near Double and a Plus 9 Fact.

Every unit in the Grade 2 sequence includes practice of the facts so that, by the end of the year, students have no (or very few) cards left in their "Facts I Am Still Working On" envelopes. The ongoing nature of this work provides teachers many opportunities to assess students' fluency with these problems. If, over time, there are students who are not moving many cards from their "Facts I Am Still Working On" to their "Facts I Know" envelopes, that is important information, and an opportunity to provide focused support and practice.

In *Investigations*, developing fluency with the addition and subtraction facts is based on work that is focused and deep. Learning a set of facts is not distinct from developing an understanding about quantities and operations, and the relationship between them. In fact, even when students are engaged in an activity that might seem like pure number practice, for example solving Number Strings, they are working to make sense of and understand the task. This flexibility and sense-making results in fluency with the addition and subtraction facts that contribute to the development of computational fluency in the primary grades and beyond.