FOCUSING IN ON

How I See Addition Facts

Jason Zimba, Student Achievement Partners

EVERY SATURDAY AT 10AM is "Saturday School" at our house. It's only an hour or so. Saturday School is never very long, but over time we still manage to do a range of things, including solving word problems, learning concepts, and doing exercises that build fluency and fact recall. Our materials include worksheets that I create, workbooks off the shelf, released test questions, homemade flashcards, and plenty of dice that we might use to play a math game.

Concerning flashcards in particular, a researcher in mathematics education saw this article of mine and later emailed me an important tip that I want to pass along:

> *"[Flashcards]…are a good fluency method [but] please stress that students should be spending most of their time on the cards they do not know yet or on those they know but are not fast on yet. Most drill uses many problems students know and thus is a big time waster."*

A similar message is **(emphasis added):**

> **"Organizing practice so that it focuses most heavily on understood but not yet fluent products and unknown factors can speed learning.** *To achieve this by the end of grade 3, students must begin working toward fluency for the easy numbers as early as possible."*

As Saturday School is not very long, time is always scarce. So, it is valuable to customize flashcard work to the student's current state of mastery. Some digital apps do allow you to adjust the settings so that students are focusing on the facts they need to focus on—maybe some of them even adjust themselves automatically over time. As we don't use digital apps, here's how I've tried to accomplish something similar using old-fashioned flashcards. I make no claim that my method is the best, or even better than others! But it has worked for us, and it's been fun.

Here's how it works:

- The flashcards are kept in a "piggy-bank" made from an old tissue box.
- We work at the dining table. My wife or I will draw a flashcard from the bank and show it.
- If the answer comes back "lickety-split," then the card is set aside. Otherwise, the card goes back in the bank. If there is doubt, then the card goes back in the bank.
- If the student is drawing a complete blank, then I prompt with a strategy, for example if the problem is 6 × 8 and the reaction is a blank stare, then I might prompt with "Do you know 5 × 8?" Then the student can say, "Oh right, that's 40, so 8 more is 48." Of course, the card goes back in the bank, but it has been a good just-in-time learning opportunity.

We'll do anywhere from 5 to 15 minutes of this, and at the end, the student "owns" all of the cards that have been set aside. The student highlights the known facts on a map (images below) and puts the cards into a keepsake box.

We use magnets to pin "maps" to metal shelves above the kids' desks. Each weekend, they chart new progress using a highlighter. The maps are a great way to recognize accomplishment. The kids love adding to the maps and seeing their maps fill up over time. Completing the map brings a strong sense of satisfaction and achievement. For my purposes, the map also suggests hypotheses about where prerequisite concepts might be lacking.

Since I've been doing Saturday School with my kids, I've continued to appreciate how intricate is the structure of the addition facts as they play out in the curriculum. My younger is learning some of the facts from memory and, for some others, applying the strategy of making ten.

At this stage of learning, making ten is a great strategy for a problem like 8 + 5. But the strategy doesn't help you in a problem like 12 + 3. To solve that problem, at this stage of learning, I'd say you want to:

- appreciate the place value structure as 10 + 2 + 3,
- know from memory that 2 + 3 = 5, and
- understand the meaning of teen numbers so that 10 + 5 = 15.

In general, each region of the $a + b$ map has its own story. This graphic shows the map with different regions color-coded. The map extends beyond the basic addition facts to include all whole-number sums with results less than or equal to 20.

0+0	1+0	2+0	3+0	4+0	5+0	6+0	7+0	8+0	9+0	10+0	11+0	12+0	13+0	14+0	15+0	16+0	17+0	18+0	19+0	20+0
0+1	1+1	2+1	3+1	4+1	5+1	6+1	7+1	8+1	9+1	10+1	11+1	12+1	13+1	14+1	15+1	16+1	17+1	18+1	19+1	
0+2	1+2	2+2	3+2	4+2	5+2	6+2	7+2	8+2	9+2	10+2	11+2	12+2	13+2	14+2	15+2	16+2	17+2	18+2		
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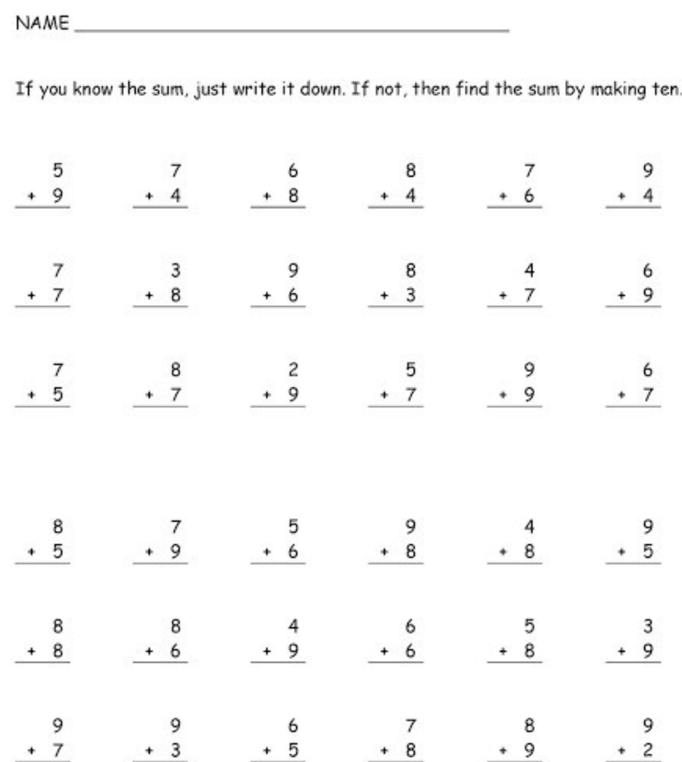
0+19	1+19																			
0+20																				

Here is a key to the colors:

6+1	Counting on
6+0	Property of 0
2+3	Addition within 10
4+6	Partners of 10
8+5	Making 10
10+7	Meaning of teen numbers
13+4	Place value computation
10+10	Link between count sequence and place value

I use this map to orient myself toward my kids' learning as they progress toward fluency with addition facts and knowing them from memory. For example, the image below shows the worksheet I made for a recent Saturday School. (Downloadable PDF here.) You'll see that the worksheet has 36 sums for practice—precisely the 36 sums that are coded yellow above. So this worksheet is for an intense practice day on making ten. Over the previous few Saturdays, we had established that the partners of 10 (magenta) were down cold, that there was fluency within 10 (red), and that the structure of the teen numbers was well understood (green). These are the key prerequisites for making ten. (Another is the ability to use properties of addition where helpful.)

The goal for single-digit sums is to know them from memory (2.OA.1). Until the goal is reached, students approach a problem like 7 + 4 as just that: a problem.


NAME ____________________

If you know the sum, just write it down. If not, then find the sum by making ten.

5 + 9	7 + 4	6 + 8	8 + 4	7 + 6	9 + 4
7 + 7	3 + 8	9 + 6	8 + 3	4 + 7	6 + 9
7 + 5	8 + 7	2 + 9	5 + 7	9 + 9	6 + 7
8 + 5	7 + 9	5 + 6	9 + 8	4 + 8	9 + 5
8 + 8	8 + 6	4 + 9	6 + 6	5 + 8	3 + 9
9 + 7	9 + 3	6 + 5	7 + 8	8 + 9	9 + 2

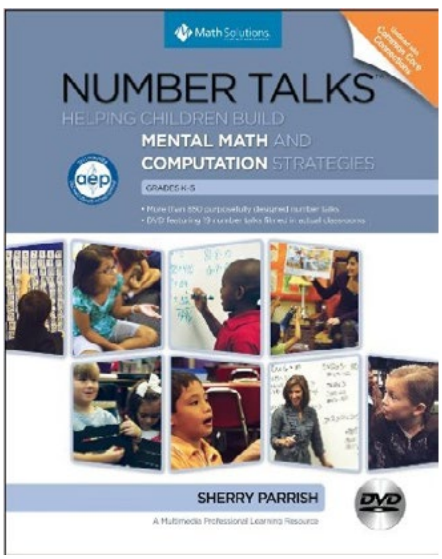
I hope the map is interesting to study and productive to think about. I know that it helps me to lay a strong foundation for future learning by focusing me and my kids on the best strategy or way of thinking about each type of addition problem.

FOCUSING IN ON

Number Talks

Tessa Ziser, CMT Editorial Panelist

I LOVE TO READ AND LOVE to learn, which is probably why teaching is my passion and career. Over the summer, I often pick up books about pedagogy, classroom management, assessments, or any other reading material that helps me grow as an educator. I also read books over the school year, but, as all teachers know, that time is always limited. Last fall, a colleague recommended a book to me while I was attending the CCTM conference in September. Because of the time of year and the cost of the book, it took me a couple months to finally purchase and read it. I am so glad I did, but wish it had been part of my library years ago. *Number Talks: Helping Children Build Mental Math and Computation Strategies* by Sherry Parrish is now an essential part of my professional library as an elementary mathematics teacher.



At the time of reading *Number Talks*, I had been frustrated with the traditional method of practicing and testing number fluency: timed tests. These tests made many of my students anxious, were taken out of context, and often did not actually tell me how fluent my students were. Some students excelled at these tests and some students were very good at memorizing the facts before they moved on to the next test. However, fluency is different from memorization. Parrish explains that our students need to be able to compute with accuracy, efficiency, and flexibility. She goes on to define these terms: "*Accuracy* denotes the ability to produce an accurate answer; *efficiency* refers to the ability to choose an appropriate, expedient strategy for a specific computation problem; and *flexibility* means the ability to use number relationships with ease in computation" (2010, p. 5). *Number Talks* helped me move beyond simply asking my students to memorize their math facts, and guide them into a stronger conceptual understanding of numbers and how they relate to each other.

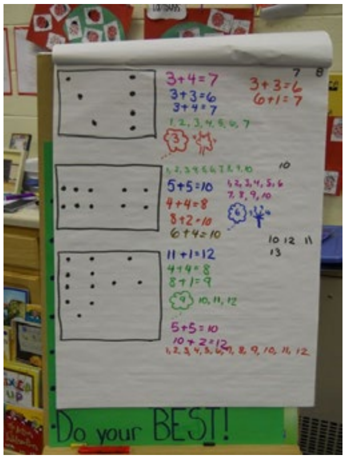
As the title suggests, Parrish introduces "number talks" as a way for students to practice computational fluency and explain their thinking. These talks support teachers in both of the Mathematics Teaching Practices from *Principles to Actions* that are highlighted in this issue of *Colorado Mathematics Teacher*: *build procedural fluency from conceptual understanding, and facilitate meaningful math discourse.*

So what exactly are number talks? Parrish explains:

> The introduction of number talks is a pivotal vehicle for developing efficient, flexible, and accurate computation strategies that build upon the key foundational ideas of mathematics such as composition and decomposition of numbers, our system of tens, and the application of properties. Classroom conversations and discussions around purposefully crafted computation problems are at the very core of number talks. These are opportunities for the class to come together to share their mathematical thinking. The problems in a number talk are designed to elicit specific strategies that focus on number relationships and number theory. Students are presented with problems in either a whole- or small-group setting and are expected to learn to mentally solve them accurately, efficiently, and flexibly. By sharing and defending their solutions and strategies, students are provided with opportunities to collectively reason about numbers while building connections to key conceptual ideas in mathematics. A typical classroom number talk can be conducted in five to fifteen minutes (2010, p. 5).

In other words, number talks are simply a structure to use in your classroom that help you facilitate conversations around number computations.

After explaining the what and why of number talks, Parrish goes on to explain, in detail, how to prepare for them. The most beneficial portion of this chapter for me was the instruction on how to record student thinking. It helped me be more comfortable and confident when first implementing this structure in my own classroom. The rest of Parrish's book contains more specific information about number talks in the K–2 and 3–5 classrooms. These chapters include many examples of different sets of equations that can be used to support good discussion. This is an especially valuable resource because it organizes the different sets based on what strategy you would like the students to be practicing and discussing. As I was implementing number talks last year, this book was always on hand so that I could quickly and easily find equations to introduce during our daily talks.



As the new school year begins, I look forward to starting number talks in my classroom on the first day of school. Convinced more than ever that timed math fact tests are not beneficial for my students (for more information and research on this topic, see Jo Boaler's article "Fluency Without Fear"), number talks will play a prominent role in helping students practice and me, as the teacher, assess fact fluency. I am excited to make them a daily part of our routine and to support students in a conceptual understanding of computations and in discourse that helps create mathematical thinkers. Sherry Parrish's *Number Talks* will be a well-used book in my 3rd grade classroom.