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A License
to
Think
on the
Road to Fact
Fluency





Lisa M. Buchholz

Several detours prompted me to find time in an overcrowded school day to incorporate important, powerful, daily, whole-class application of fact strategies.

A few years ago, I embarked on a journey with my second graders, a journey through the strategies for mental computation of addition and subtraction facts. The focus of that journey was to help my students use their “license to think” in math, to help them happily, successfully, and fearlessly compute in their heads with understanding and fluency. I wanted my students to deepen their number sense and to realize that, for example, $8 + 9$ is not something to fear. I wanted my students to see $8 + 9$ and think, “I don’t like you, $8 + 9$, but I *do* like $8 + 8$; and I know that is 16, and one more makes 17!”

This was a great plan for the entire year that I taught second grade. Even my first few years back in a first-grade classroom proved successful, and my students astounded me with their love of mental computation. First-grade math felt so “right.” During math time, we happily played with numbers in our heads, and math lessons were determined by the needs of the students within the framework of the curriculum objectives.

Dawn of a math tragedy

That was our happy math existence until time became the enemy as a direct result of my district’s adoption of a new math series. Until this time, we had curriculum goals as well as resources that the district provided to help us achieve the goals. Now life was different. This new series directed teachers to teach with “fidelity.” The representatives told us to follow lesson by lesson, day by day, unit by unit, with no thought of what our students needed or where their interest or enthusiasm could take us. Even worse, the context of the new math series did not value strategies for mental computation. About half of one lesson was devoted to doubles and near doubles in first grade. As a member of my district’s math committee, this was a huge red flag to me. On the one hand, I felt the need to live the program and support it. However, I

did not let the lack of strategy work go unnoticed. I specifically asked the representative if the series left room for strategy instruction. She confidently told me that students would memorize the facts through playing games. I was such a believer in the strategies that I immediately began to panic inside. The only way I was able to calm myself was by thinking, “No problem. I will just teach strategies on the sly. I will just find a way to fit them in.”

So, lesson by lesson, day by day, unit by unit, my students and I plodded along. As time allowed, we studied strategies for mental computation. It was not easy that first year, but we did it. I actually made it through all the strategies that I had focused on in previous years, a big accomplishment. I had managed to teach the whole program *and* study strategies.

And then June arrived and with it the end-of-the-year fact timing, which my district decided to continue administering. I handed out the papers with a *very* false sense of confidence. My students usually did a great job on the timings because we were number lovers. We were on the road to fact fluency and had the license to think. We were in touch with our strategies. Well, I was in for a huge surprise.

A day I will never forget

I began the timing and walked around the room observing. Immediately, I noticed many students using their fingers. *Fingers?! After several years’ worth of students who viewed mental computation as a fun challenge to embrace, I now witnessed my first graders using their fingers; skipping the “harder” facts; staring blankly at their paper with no mental “tools” to use, no fluency, no confidence or excitement—and time ticked away. At the end of a very long minute, I was left with many half-empty papers and the realization that I had just failed my first graders. Even now, a few years later, it pains me to write these words. I had failed my first graders. Now all that was left for me was a lot of reflection and soul searching.*

Much-needed reflection

As I studied my students’ papers, my mind began firing off questions. Each question plunged me farther into the abyss of failure. This may sound dramatic, but it is how I felt. My math world was rocked. What did I do wrong?

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Why was this year different? Why did these first graders have such different results from last year's? How much time did I spend on strategies this year versus the previous years? Did I deliver the strategies in a different way? How do you teach a series with fidelity when you know that your students need more? How can I have more time for what I know is important?

To this day, some of my questions still need answers. I continue learning how to marry the world of objectives (and now, Common Core State Standards, too) with a math series. I have lived this reality for my fourth year and am managing better each year. Although I still struggle with some of my questions, I am happy that this reflection has led me to a fact fluency revelation.

The importance of continuing education

I actually came to a *huge* realization. All my questions led me straight to the answer that was so obvious. I even consulted my previous *Teaching Children Mathematics (TCM)* article from 2004 (about my original “journey” with fact strategies). As I read that article, some words jumped out at me and shouted, “Here’s your answer!” In my own article, I was talking of the power of *daily* strategy practice. I had stated,

The more strategies we learned, the longer our mental math time took. Every minute was worth it. My students seemed to be picturing one another’s strategies mentally. This combination of an intense study of strategies and a daily opportunity for practice added up to success. (Buchholz 2004, p. 365)

Duh! *Daily* opportunity. These students needed *continuing education* for their “license to think.” I absolutely knew this and had lived it in my classroom. However, my frantic math treadmill of lesson by lesson, day by day, unit by unit had overshadowed daily mental math workouts. I did not realize that such a subtle, yet huge, piece of my strategies program had been “shelved” because of a lack of time. I had felt a false sense of pride for including my study of strategies, but it was not enough.

Yes, I had facilitated a study of the fact strategies. Yes, the strategies had been introduced and studied with the same passion as in years

FIGURE 1

During her year as a second- and third-grade math and science teacher, Buchholz created these sample calendar pieces for second graders and was able to still weave in strategy work.



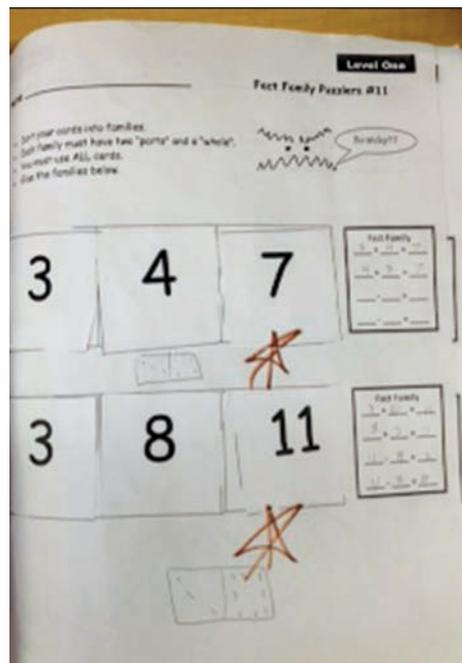
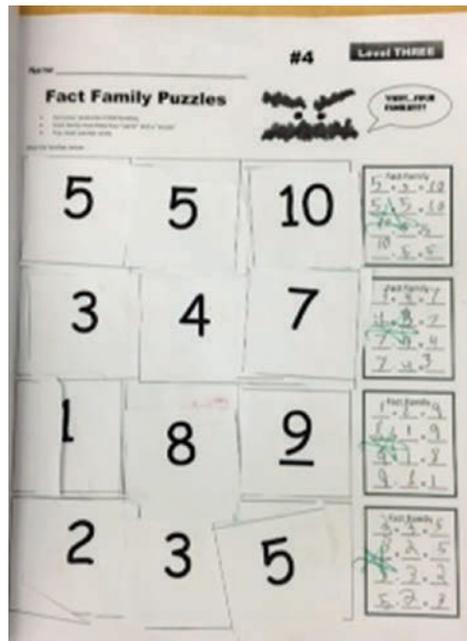
KALLA BUCHHOLZ

before. Yes, I had spent the same amount of time for each strategy and stressed the importance of mental computation versus fingers. But, no, I did not take the time for the *daily* application of strategies. No, I did not have whole-class debates over which strategy would be most efficient for which fact (as I had in the past). Ugh!

To further torment myself, I headed straight for my favorite source of information, the book that guides my way through every math dilemma: *Elementary and Middle School Mathematics: Teaching Developmentally* (Van de Walle 2001). In a section titled, “A Three-Step Approach to Fact Mastery,” Van de Walle states that we must “provide practice in the use and selection of these strategies” (p. 128). He also mentioned planning lessons that allow development of the strategies taught. Clearly, one cannot just teach the strategies; the strategies

FIGURE 2

To help her students tackle subtraction by thinking about addition, the author creates a leveled series of fact family challenge books for them to use daily. Students determine the fact families, then write the resulting equation.



must be developed through daily application. I felt as if Van de Walle had thrown a cold glass of water in my face.

I had also stumbled across an article from the publication *Growing Professionally: Readings from NCTM Publications for Grades K–8* (NCTM 2008). This compilation of articles includes “Strategies for Advancing Children’s Mathematical Thinking” (Fraivillig 2001), which states the importance of allowing students opportunities to express and analyze their thinking. The focus of the article is how students can become better mathematical thinkers when given opportunities to solve problems, explain their thinking in a safe and encouraging classroom setting, and recognize one another’s errors and efforts as well as the contributions they and their peers make to the learning. Specifically, Fraivillig states,

An important step in advancing children’s thinking is to challenge the children to describe and analyze their solution methods. (p. 176)

She further states that teachers should consider—

how they might get children’s thinking out in the open for discussion and build instruction on that thinking. (p. 180)

The big question that I asked myself after reading this article was, “What was I thinking?” Clearly, I had lost sight of something so important to mathematics learning, and I had to bring it back.

A new year, a new game plan

After that first year with the textbook series, I could hardly wait to get back into the classroom and make things right again. I wanted to restore the student-driven math classroom of my recent past while still using the new series in a manner that kept its desired integrity. Even from the first day of school, I now had a strategy focus. The intense strategy study would not come until midyear, but the exploration began on day one with calendar time. Instead of the “traditional” first-grade calendar, I had always been a fan of placing expressions or other number representations on the back of the

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calendar pieces. This way, students must *find* the day and then check to see if it matches the pattern of the pieces. During this particular school year, I made sure that I included all sums of ten, doubles, and doubles-plus-one equations (and their related subtraction facts) each month on the calendar pieces. This became a quick, easy, and *daily* way for us to talk about *how* we got our answers. For $4 + 5$, I heard comments like the following:

Kira: I started with four fingers and added five more.

Katelyn: I started on five and added four more.

Jack: I knew five plus five was ten, so I took one away.

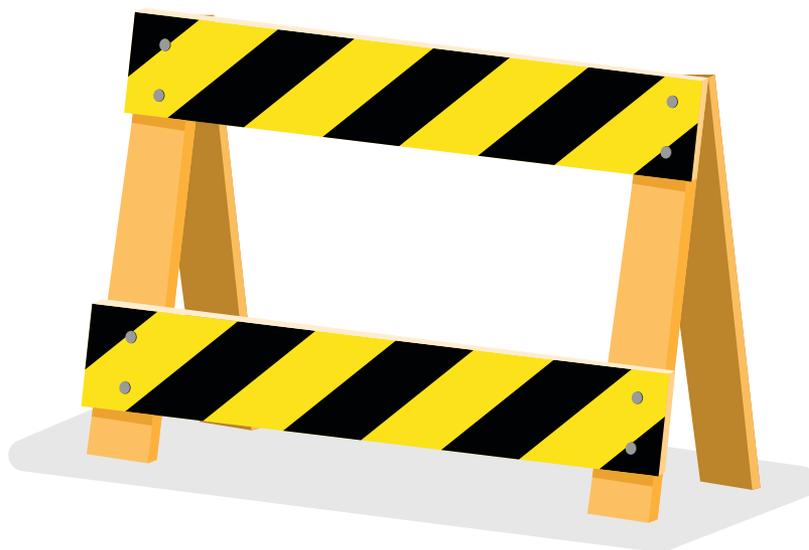
Nikki: I knew four plus four was eight, so I added one more.

These calendar conversations were so easy to fit into the day, yet so powerful. Before long, the children already knew the terms *doubles*, *doubles plus one*, *doubles minus one*, and *sums of ten*. Life already felt better. All this daily strategy talk got me proactively thinking about strategies in my classroom. My mind began swimming with ways that I could infuse strategies into daily activities, even in September, just to lay some groundwork and give some exposure to students who were ready.

Daily strategy opportunities

As the year went on, I gradually began studying the strategies with my first graders. I actually adapted my daily schedule so that I had more than one hour for my math block. (I have always been a firm believer in the power of integrating within and between subjects in the elementary grades. This is a true art that is unique to us elementary school teachers, and it is how I gained more time.) As we learned strategies, I was looking for ways to put the strategy application and discussion into the spotlight. The following is a list of places and times where this daily strategy immersion occurred.

- **Calendar time**—As mentioned, I used addition and subtraction expressions to represent the numbers on the calendar. The first graders loved explaining their thinking. Even my struggling students



started thinking $4 + 4 + 1$ or $5 + 5 - 1$ versus $4 + 5$.

- **Daily mental math time**—Many different activities took place at this time. One of our favorites was when I would give students three numbers to add mentally. The focus was not on the answer but on the strategies they used. We would ultimately choose a strategy that seemed the fastest. For example, with $2 + 8 + 6$, one student might think, $2 + 8 = 10$, $10 + 6 = 16$. Another child might think, $8 + 6 = 14$, $14 + 2 = 16$. A third one might think, $6 + 2 = 8$, $8 + 8 = 16$. My first graders determined on their own that any solution involving counting up would take longer. These strategy conversations were a productive, important part of our day.
- **Fact family challenge book**—I believe in the importance of teaching students to tackle subtraction by thinking of addition. For this reason, I created fact family challenge books for all the math strands. My

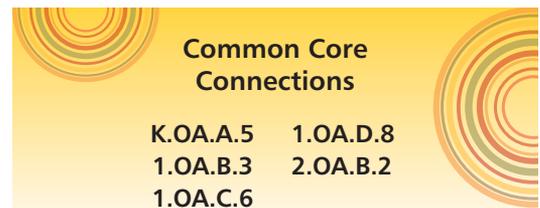


students use this leveled series during daily 15-minute challenge book times. This was an easy way to get strategy work back into our day. In their book, students get two scrambled fact families (then eventually three families, then four families; after four fact families, the focus switches to multiplication families). Job one is to determine the fact families. Then students write the resulting equations. I am amazed at how much this booklet alone helps with subtraction facts because, in other math work, the children visualize the fact family cards that they have worked with.

- **Flashcards by strategy**—Students take these cards home as we study the strategy at school. The cards are attached to a parent information sheet that explains the strategy. As I teach new strategies, new information and cards go home with the students. Parents are educated to look for the use of *strategies* versus the use of *fingers*.
- **Games**—I have created many fact strategy games that can be played with any combination of strategies. One of our favorites is called Fact Flurry. For the doubles version, I write a number on each quarter-sheet of paper (one per student). The students then crumple the paper into a ball. When I say, “Fact Flurry,” students throw their “snowballs” to the front of the classroom. They then each retrieve one snowball and double its number and write it on their recording log. The student with the most two-digit sums at the end of the game is the winner. I have created Fact Flurry and other games for all the key fluency strategies. These games are a quick, daily application of strategies, and students often request them when we have indoor recess.
- **Fact strategy posters around the classroom**—After studying each fact strategy, we create a poster to help us recall the strategy. These posters are displayed around the classroom, and students use them daily in their computation.

Goodbye, fingers; hello, fluency

So, from a nightmare came a teacher’s dream: a class of fact-fluent students with a grounded sense of number; a class full of students who know how to articulate their thinking and analyze it next to the thinking of their classmates. What holds true for students holds true for us educators: Making mistakes and learning from those mistakes can make us stronger. I feel like a teacher who is wiser from this experience. I now hold dearly to what I know to be effective for students, and I am always on the lookout for anything that might derail a good foundation in early mathematics.



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