

Connecting Mathematics and Writing Workshop: It's Kinda Like Ice Skating

Susan Carter

There was a lot to think about and I got frustrated and struggled and then I played with my numbers. Then, I got the hang of it. It was kinda like going ice skating. Hard at first but fun at the end.

This student's reflection from her math notebook struck me, not only because of the sharp literary comparison of learning mathematics and learning to ice skate, but also because the student used literacy skills (making connections and using figurative language) to help the reader understand how she was feeling about math. I began to wonder, Could writing about mathematics outside of math class help my students better understand their own strategies as well as the strategies of other students?

It has been my fortunate experience to navigate both first and second grade with a group of insightful and talented writers. They read voraciously and tend to peruse a variety of genres in their choice of independent reading. Their prodigious writing reflects their reading style. They churn out story after delightful story ranging from touching personal narratives to detailed expository reports on scientific topics. Beginning in first grade, my lessons focused on connecting reading and writing: using author studies and mentor texts, reflecting on oneself as a writer, and giving constructive feedback during Author's Chair.

During Writing Workshop, my second-grade students usually write to topics of their own choice and design. They are on the cusp of the transition to using writing primarily in the content areas. In anticipation of the dreaded "fourth-grade slump" (Chall, Jacobs, & Baldwin, 1990), I want to prepare my students now to enjoy reading and writing in the content areas in third grade and above (Moss, 2005). Students with strong writing skills should be able to apply writing skills in other contexts. Most of my students write detailed responses to questions and interesting essays during science or social studies. The missing link

became their inability to apply literacy skills in math class.

I have been using a popular standards-based mathematics curriculum that frequently asks students to explain their thinking and show their work. Standards published by the National Council of Teachers of Mathematics (NCTM, 2000) have suggested that students should be able to communicate mathematical thinking coherently and clearly to teachers and to other students. They should be precise with mathematical language and be able to analyze other people's mathematical strategies. NCTM (2000) has acknowledged the daunting nature of teaching students to write effectively about math content. When called upon to write during math class, my talented wonderful writers tend to freeze up or fall apart.

Reading trade books with mathematical themes is an excellent way to engage students with mathematical topics. I use picture books throughout the year to introduce, review, or extend certain topics. This time I wanted to go beyond connecting reading and mathematics by reading a trade book and doing a mathematical task related to the story. Although using literature to connect with a math lesson is a wonderful way to involve students in both literacy and mathematical thinking (Whitin & Wilde, 1992, 1995), my goal was for my students to be able to write in the content area of mathematics using appropriate vocabulary and sound mathematical thinking. I decided to use picture books as a springboard to consider mathematical writing during Writing Workshop.

Bringing Writing to Math Class

As math assignment after math assignment returned with vague explanations or blank lines, I reflected on my instructional choices. I thought about how and what I teach, not only during math but also throughout the day. I needed to build the bridge between writing and mathematics. As a whole, my students

perform better than average in mathematics and in writing, but they were terrible at writing during math class. My quest became to connect these two crucial content areas.

One day during math class a student was at the board explaining a problem that involved finding half of a dozen. She drew twelve circles on the board in rows of six. Then she drew a line down the middle to create two groups of six. "Six is a half-dozen," she said.

"Questions or comments?" I asked the other students.

"How did you know the answer so fast?" asked one girl.

The student at the board quickly launched into a detailed story about going to the bakery with her mom. What happened next changed the way I thought about writing and math. She told about how her mom needed to get donuts for a meeting, and how she found out about half of a dozen, a dozen, and a baker's dozen. Students were nodding along in understanding. Much of the storytelling we do in math class involves stilted word problems with a question at the end. This storytelling was different. Students connected with the story because it had real-life meaning to them. I noticed several students using the same representation that had been drawn on the board in later problems, and I wondered if it was more memorable to them because of the story attached.

I refocused my energy on giving my students the time and tools to think and write about mathematics on a more personal level. To increase understanding, teachers need to help students connect literature with their lives and other content areas (Hyde, 2006).

After reading about the use of writers' notebooks in the upper elementary grades (Fletcher, 1996; Fountas & Pinnell, 2001) I decided to begin using mathematical notebooks to help improve my students' abilities to write about math. The journals were made of 8½-inch by 11-inch blank white paper, covered with construction paper and divided into three sections labeled Strategies, Questions, and Reflections.

At the end of each math activity, my students wrote in their journals about progress they made with the strategies they used, questions they still had, or reflections they used to monitor their own thinking. The journals had plenty of room to draw pictures or write informally. Reading the journals gave me information about how my students were thinking about the math they were doing in class. It also helped students monitor their own mathematical progress and see how their thinking changed over time.

Bringing Math to Writing Workshop

In addition to including writing during math class, I also initiated a mathematics focus week during our Writing Workshop. To begin planning the unit, I drew on my knowledge of how students acquire literacy skills. They begin by listening, then experimenting orally, revising oral patterns, and finally making sense on paper. Could numerical awareness be developed in the same way as phonemic and phonological awareness? Students have been listening to me explain my thinking about problem solving in math throughout first and second grade. I purposely began to use several sentence frames repeatedly (see Figure 1), so that students would have an appropriate

Figure 1
Sentence Frames for Reflecting on Mathematical Thinking

- At first I was going to try _____, but then I decided to _____.
- I thought about what _____ said the other day and decided to try his/her strategy.
- Once I found where I got stuck, I tried the problem again from the beginning. This time I decided to try _____.
- The mistake I made here was _____, and it made me think that next time I should _____.
- When I started this problem, it reminded me of _____, so I used the strategy where _____.

model for writing about mathematical thinking in the future. Think-alouds like these help students visualize mental processes that would otherwise be invisible (Wilhelm, 2001).

During math class I implemented a system where students are called upon to explain their strategy or thinking to the rest of the class just as a teacher might explain a lesson. Students can sometimes explain concepts to one another in a way that may not have occurred to me because they use examples that make sense to them. The implicit acknowledgment that everyone's thinking has value also adds to the positive, nonthreatening climate of the classroom.

We create meaning together through conversation about mathematical topics. I want my students to know that math is not just about computation; it is conversation as well. This conversation builds their mathematical vocabulary and provides a model for them to put their own thoughts into words. My students needed opportunities to ask questions and scaffold one another's learning. Group work provided that essential collaborative discussion time (Yackel, Cobb, & Wood, 1991). During math group work, I acted as facilitator and coach, circulating and asking guiding questions when the need arose.

Finally, after months of oral practice, my students were ready to attempt to integrate mathematical thinking and their Writing Workshop. My first minilesson on this topic began with the announcement that we would undertake a new and exciting experiment—using what we know about learning and doing math to help other children learn and do math better. We intended to write and publish stories that would help children think about math in a new way.

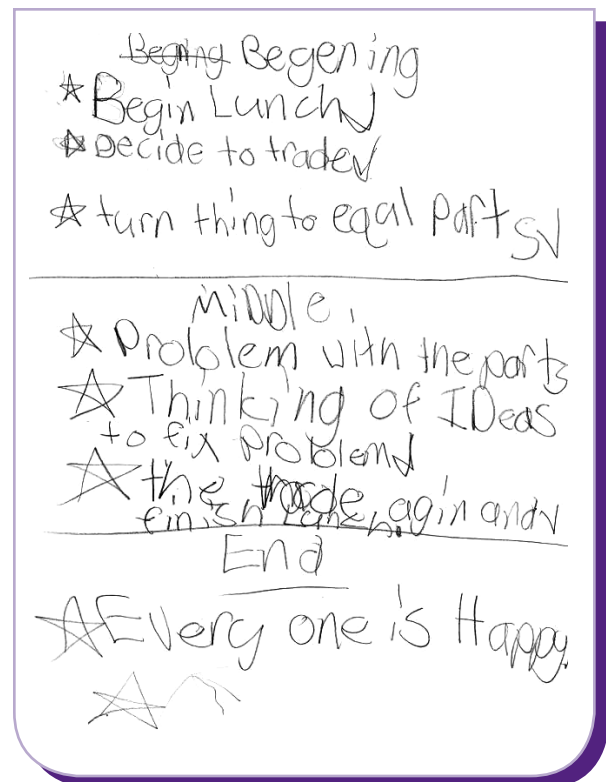
Another minilesson focused on the importance of using illustrations to support understanding. In Writing Workshop, early writers use illustrations to support or extend the text. In math class, students use representations or sketches to solidify their mathematical ideas. Drawing a parallel between illustrating and representing allowed students to connect their mathematical ideas with their literacy skills. My selection of paper for drafting and publishing was crucial to this connection because I limited students' choices to paper with space for an illustration on each page.

According to Calkins (2003), materials convey expectations. I expect students to use illustrations to depict the math in the story in a more detailed way than they would represent their thinking in math class. As

students increase their stamina and volume of writing, they tend to use illustrations to summarize or enhance the action of the story. By second grade, many students have moved away from choosing “picture paper” to using loose-leaf paper or handwriting paper without pictures. By second grade, students have grasped the idea that the story is contained in the text, not the illustrations. In contrast, during math class students are encouraged to draw symbols or sketches to demonstrate problem-solving skills (NCTM, 2000). The math is contained in the pictures.

For young children, using illustrations is often essential to help understand the math in the story (Foster, 2007). Students attempted to incorporate mathematics into a story and pictures that would help the reader think about mathematics in a new or deeper way. The illustrations included representations of the math problem or situation embedded in the story. After reviewing our math content journals for ideas, we brainstormed a list of topics and began to prewrite. Figure 2 shows an example of how one student organized her thoughts before beginning her draft.

Figure 2
A Student's Organizational Outline



I expected resistance, as my students tend to be protective of their writing time, and I didn't know if they would like to share the time with mathematics. Instead, they surprised me and produced both fiction and nonfiction titles such as "The Hexagon Adventure," or "How I Learned to Do Math in Kindergarten and Beyond." The story entitled "The Great Trade" explained how two girls used knowledge of equal shares to make a fair trade at the lunch table (see Figure 3 and Figure 4). The frames I had provided orally showed up in several nonfiction stories, and were used to explain complex mathematical situations.

During Author's Chair, students made comments or asked questions not only about aspects of writing, but also about how the math is handled in the story. As a result, students helped one another revise their mathematical thinking during Author's Chair in a way that had never happened in our math class. After one student shared her story, "The Magical Subtracting Frying Pan," another student commented on the way subtracting in her story sounded like dividing up the

cookies in *The Doorbell Rang* (Hutchins, 1986). I just about fell out of my chair. We had read Pat Hutchins's book in first grade and did an activity where students acted out dividing up the cookies. Having students spontaneously make text-to-text connections and connect repeated subtraction and division before the concept had been introduced in math class was a surprise.

Another surprise was the renewed spirit of excitement about writing that permeated the classroom. I implemented this approach late in the school year, and many students were feeling the typical late spring writing fatigue that comes with the return from spring break. Using mathematical writing as a genre made math and writing seem new again. The room was humming with activity during writing workshop as students were rereading more carefully to double-check the math in their stories. Requiring illustrations reopened the need for art supplies. My students wore out enough crayons and markers that I actually had to restock in early May.

Figure 3
First Part of a Student's Story

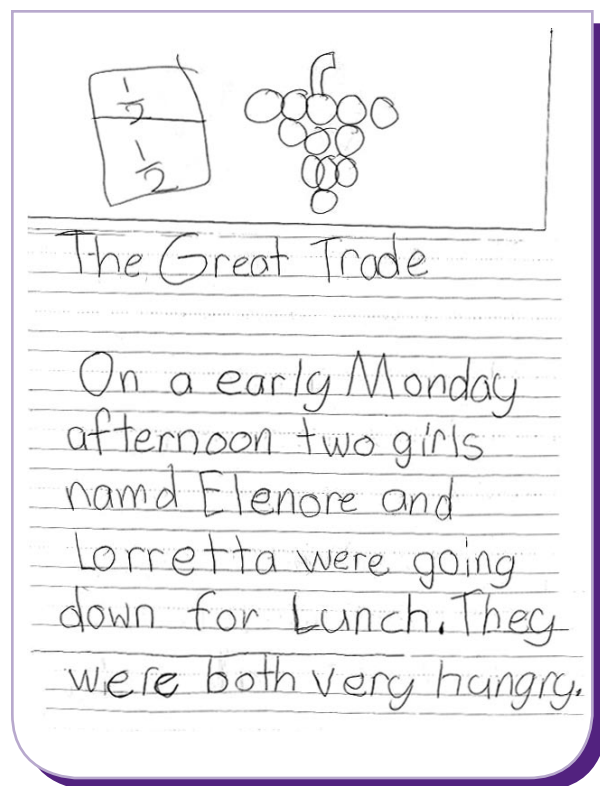
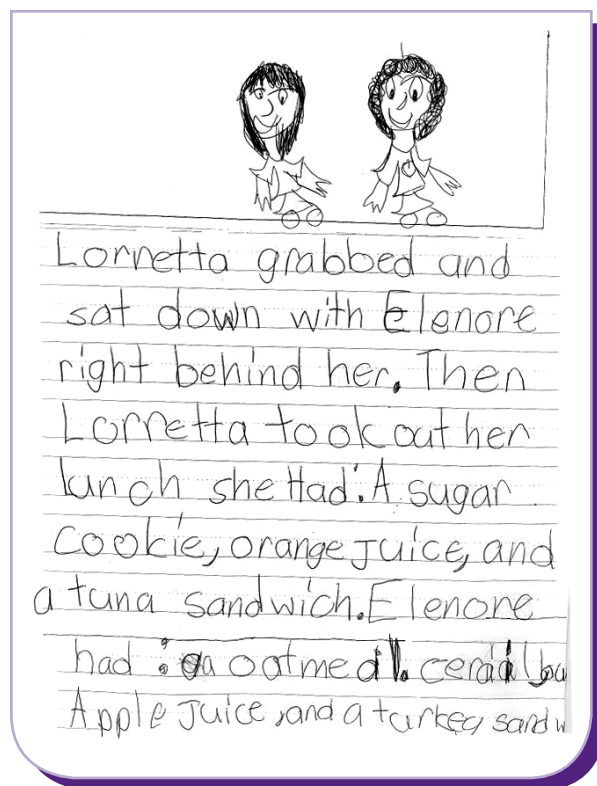


Figure 4
Second Part of a Student's Story



Connecting Two Curricular Areas Means Improvements in Both

Adding writing in reflective journals to my daily routine in math class extended my students' thinking about the strategies they use to problem solve in math class. Introducing mathematical writing as a genre during Writing Workshop resulted in worthwhile and easy to understand stories about mathematical thinking. The two-pronged approach connected math and literacy in a new way for my students. Welcoming the precise language of mathematical thinking into our writing workshop gave students permission to sneak their literary talents into writing during math class. In the future, I plan to continue this approach throughout the year and incorporate more mathematical picture books as mentor texts in Writing Workshop. It is an exciting moment for a teacher when an attempt to connect two curricular areas improves student performance in both areas. Now, I may just try learning to ice skate.

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Carter teaches in the Clayton School District in St. Louis, Missouri, USA; e-mail susan_carter@clayton.k12.mo.us