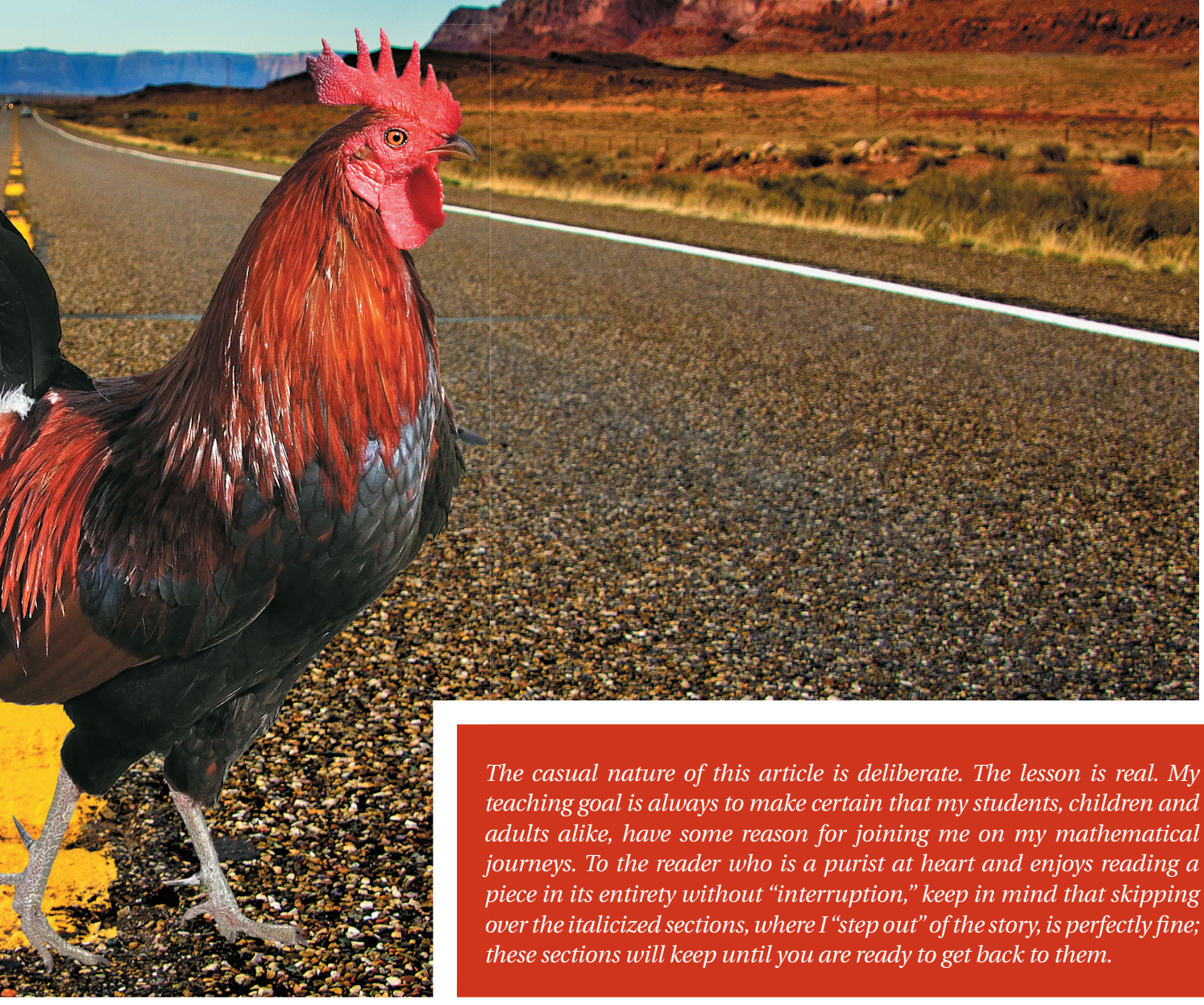
Memories of a Chicken-and-a-Half

Step in and out of an impromptu fifth-grade math lesson with an experienced teacher, and renew your appreciation for students' algebraic thinking.

By Steven M. Schulman



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The casual nature of this article is deliberate. The lesson is real. My teaching goal is always to make certain that my students, children and adults alike, have some reason for joining me on my mathematical journeys. To the reader who is a purist at heart and enjoys reading a piece in its entirety without "interruption," keep in mind that skipping over the italicized sections, where I "step out" of the story, is perfectly fine; these sections will keep until you are ready to get back to them.

Many years ago, I happened on a type of teacher development opportunity quite by accident. I was teaching a fifth-grade class every day and a math methods course one evening a week at a nearby university. I would present a lesson to teachers in the evening and discover that I was giving the corresponding lesson to children a day or two later. I tentatively presented the idea of being intentional about it and sharing the experience with my teachers-to-be: "How would you like to see this topic offered to children, in their own classroom, using some of the techniques we just worked on?"

Given that so many of the adult students had jobs during the day, I was surprised when several of them took me up on the offer. Consulting with the principal of my elementary school turned out to be less complicated than I expected; the chance to showcase our school delighted him. Furthermore, the school would grow in prestige as one that was cooperating with a university. We needed only to find a manageable way to check my college students into and out of our elementary school. The security staff was more than happy to comply. My greatest challenge in all of this was fashioning a lesson that would stimulate both groups of students. I had to be able to communicate with the children and the adults so that everyone would be able to tell when they were the intended target of my questions and comments. The solution turned out to be learning to "step into" and "step out of" my own lesson (without tripping up).

Try to imagine a situation where you are observing a classroom lesson. The teacher "pauses" the lesson: "Boys and girls, I am going to ask you to continue what you are doing for a few minutes while I step out of our lesson to speak with our guests about what we have been doing here." And then the teacher might address the guests: "Why do you suppose I asked that last question? Where do you expect I might be going with this?" and so on until turning back to the class. "OK, boys and girls, I am stepping back into our lesson now. I am anxious to see what you have come up with."

Over the years, I have learned that the impact I have on young teachers is a variable and that I am able to amplify this impact considerably with the choices I make. A technique I have learned to depend on requires that I somehow actively involve new teachers in my lesson, much as I did when I invited young teachers to my elementary school classroom. When live, in-person "two-group" lessons became harder and harder to arrange, I searched for practical, effective alternatives.

At first, embedding relevant audiotapes and videotapes into my method course presentations seemed like a reasonable alternative. I decided that we had something to gain from watching and listening to the tapes even if this option was not exactly what I was looking for. The experience lacked the personal touch. Although teachers watched and listened together, they were not part of the lesson itself. Perhaps they had nothing at stake.

I wondered if a written format would be a better option. A lesson that recounts an event in my life would have the personal touch. More important, it would be personal to a new teacher because it would be authentic and at the same time require a reader's commitment and personal involvement to see the activity through. I knew that to be successful, I should strive to make the lesson tantalizing and amusing in addition to making a mathematical point. (It occurred to me that without a point, I might never be trusted again.)

I am certainly holding an unconventional lesson up to scrutiny; however, I am also highlighting the excitement of pedagogy. The following lesson provides me with the unusual opportunity to call attention to strategies that have had a long history and remarkable results. With careful inspection, readers may recognize the lesson as a Discovery lesson (Davis 1992, p. 339) or a Socratic lesson (Pólya 1966) much as it was delivered during the 1960's reform of mathematics education. The approach is unique in a number of ways:

- *The lesson begins with the teacher wondering about something that is cognitively irresistible to students.*
- *The class spends time understanding the problem.*
- *The teacher tells little, instead relying on carefully selected questions and finding something positive in each student response.*
- *Although the instructor may support students along the way, the students alone must take the final steps. That is to say, to reach a solution may take longer than a single lesson.*
- *Someone who teaches this kind of lesson would be unlikely to announce an answer to anyone. In fact, even the students are told that they must not announce the answer out loud, as that would terminate the considerable thinking that is going on in the classroom. Instead, students are encouraged to turn in a written answer with their name on it.*

My personal experience is that when I talk about a lesson to teachers, they imitate my modeling and talk to their students about a lesson. A far more effective teaching approach is to drop my new teachers into a lesson together and rely on the faith I have in the mathematics I teach, the pedagogy I am using, and the eagerness I have experienced of our children to learn.

⇢ reflect and discuss

"Memories of a Chicken-and-a-Half"

Reflective teaching is a process of self-observation and self-evaluation. It means looking at your classroom practice, thinking about what you do and why you do it, and then evaluating whether it works. By collecting information about what goes on in our classrooms, and then analyzing and evaluating this information, we identify and explore our own practices and underlying beliefs.

The following questions related to "Memories of a Chicken-and-a-Half" by Steven M. Schulman are suggested prompts to aid you in reflecting independently on the article, discussing it with your colleagues, and using the authors' ideas to benefit your own classroom practice.

- What does the teacher mean when he writes, "My job is to paint the first idea as *courageous*"?
- What does it mean for children to *take ownership*?
- What are some phrases a teacher might say to sustain student thinking?
- How is a teacher able to *step back* if students are not yet ready to proceed?
- What does the teacher mean when he says, "You want to tip the proverbial scale a little to overcome the stubbornness of inertia"?
- Why would the teacher say, "If you see your name, you did it wrong"?

Tell us how you used Reflect and Discuss as part of your professional development. Submit letters to *Teaching Children Mathematics* at **tcm@nctm.org**. Include Readers Exchange in the subject line. Find more information and submission guidelines at **tcmmsubmit.net**.

Stepping into the story

I awoke this morning to thoughts about my father. For some reason, an old math problem he had challenged me with as a child had surfaced in my head. It was not that my father searched the world for just the right problem. He did not have any particular affinity for mathematics. As a salad man—or counterman—in a small Brooklyn store, his version of mathematics was the list of numbers he wrote and added on brown paper bags. You did not want to disturb him while he was doing this. It would make him start all over again, which he hated. I remember once asking him about the white pencil he kept tucked over his left ear: "Dad, you're right-handed. Why is the pencil over your left ear?"

He replied, "It's good exercise!"

He had acquired this particular math problem while relaxing on a bench in our neighborhood—apparently what our parents did when they were not at work and yet were feeling social. They would sit on benches with other parents and share pleasantries, jokes, and stories as well as riddles, puzzles, and problems. Mostly they talked about their children. I could imagine someone chatting with my father:

> Irving, here's a good problem. Pass it on to Steven. He likes math. The problem goes like this:
>
> If a chicken-and-a-half
> Lay an egg-and-a-half
> In a day-and-a-half,
> How many eggs
> Will a chicken lay
> In twenty-one days?

The fact that my father came home one day with this problem did not mean that he came home with the answer. He had opinions: "Sam said this; Murray thought that; Sidney said it was something else." But what Sam or Murray or Sidney said did not matter to me. They were not authorities.

This problem lay around in the recesses of my mind for many years. Perhaps it was melodic or haunting, or had some unique rhythm to it. For some reason I do not understand, it stuck in my mind. And one day it erupted from my lips as easily as a recitation of the alphabet. By then, I had begun teaching elementary school. Although my classroom responsibilities included spelling, handwriting, and checking for head lice, I grew particularly fond of teaching mathematics. One day, when a math lesson that was supposed to take 45 minutes took only 20, I was suddenly confronted with thirty-two beautiful children and 25 more minutes to manage. Introducing the problem was an ingenious idea, if I do say so myself. (Why is it that no one is ever observing at such times?) After I had announced the problem to the class, my students took it over and forced me to see it like I had never seen it before.

"How could you have a *half*-chicken?

"My mother *bakes* a half-chicken."

"When you have half an egg, where does the yolk go? Isn't that messy? Ugh!"

"I won't eat eggs."

"My big brother threw an egg once. It was the last time he ever …"

"Mr. Schulman, why does a half-chicken cross the road?"

Before I could answer the last question, another student exclaimed, "To find its other half!"

"Isn't it something about the other side of the road?" someone else contributed.

And then, "Who wants to be walking around with your guts hanging out?"

The problem was becoming surprisingly graphic, but hands were raised—flailing, actually—and there was such excitement in the classroom that not a single student was waiting to be called on before speaking. The problem seemed to have immediate appeal. It was early in my teaching career, and I had never seen anything quite like this. I certainly had not learned how to handle *this* in a methods course. I did what I perceived any good teacher would do under these circumstances: I closed our door.

As I looked around the room, I discovered one little girl who was not jumping around like the other students. She appeared to be deep in thought. I assumed she was either mulling the problem over or planning her escape. Using my authoritative voice, I said, "Dorothy, tell me what you're thinking about." Suddenly the room became silent as other students realized I could call on them too.

"I'm thinking that this is a story, right?"

"Yes."

"And if it's a story and made up, then it can be anything we want it to be. Right?"

"Yes."

"So can't we just suppose there's a half-chicken and half an egg without everybody getting crazy about it?" Dorothy rolled her eyes. She was obviously somebody's big sister.

It was a teaching moment, so I took advantage of it. I spoke to the class. "What do you think about what Dorothy is saying?" adding quickly and cautiously, "One at a time."

"She's saying 'suppose'…?"

"Yes, she is. What do you think about that?"

"It's good. It's good 'cause then we can quiet down and finally get to think about this."

I addressed the class again: "So, could it be that we're done laughing? Can I see some serious faces here?" And then I addressed the thoughtful girl, "Dorothy, that *was* a great idea. It's getting us to think about this problem, and you'll see it is a good problem. So let's get into this thinking."

As my eyes moved from face to face, I saw the same prevalent expression. My students were like timid soldiers embarking on their first battle. They were energized by the thought of not having to tackle this alone and at the same time frightened that they might not make it through. (There are far more casualties in fifth grade than we can count.) As usual, I crossed my fingers in my pocket before I asked the next question. With an elaborate lead-in like this, so much was at stake.

"Does anyone have any ideas about how to begin a problem like this?" I asked. Someone always has an idea. My job is to paint the first idea as *courageous*, for it will usually bring about other ideas. Even this early in my career as a teacher, I had already learned that my students must take ownership of a problem for them to genuinely feel the thrill of the solution. Taking ownership is a process: It begins with the students acknowledging that a problem is worth solving; the process continues with students exhibiting perseverance; and it ends with one kind of closure or another.

I too had mixed feelings: I was eager to get started, but there is always the danger that my students will fail to find a solution. How would failure affect their willingness to take on the next problem? I considered preventative measures. I reviewed pedagogy techniques that sustain thinking. I could meet any student answer with, "What do you think about that?" This safe reply provides thinking time for everyone, with no indication of failure. If students did not initially express much enthusiasm or determination, I even knew a safe way to take a step back: "It seems to me that we need more time to think about this. Do you think we will be ready to talk about this tomorrow? I guess we will see how your thinking goes tonight."

Listening is a virtue. Sometimes you are bailed out by the simplest of questions. A student asked, "What do we have to find here?" (Isn't this what problem solving is always about?)

"This problem has a lot of words," I answered. "Are there any words that are telling us what we have to find, asking us a question? What do you suppose would happen if we separated that part of the problem from the rest of the problem?"

A teacher hopes that a child will point out how the problem leaves you with two smaller pieces to look at and how each piece has fewer words. If we then begin with the question, we will first discover what the problem is asking, and this will give us clues about what to look for in the rest of the problem. Sometimes students are comfortable with such words and phrases as *data*, *given*, or *other stuff*. When I looked at this other stuff, I noticed that there was no *chicken*. There was only a *chicken-and-a-half*.

"When you look closely at the question," I remarked, "you notice that the problem is asking you about 'a chicken' not 'a chicken-and-a-half.' Having called one part of the problem *the question*," I asked, "what should we call the rest of the problem?"

How do you turn a chicken-and-a-half into a chicken? I suggested to my students that they describe to me what was really happening in this other stuff. What were the chicken-and-a-half doing? How long does it take for them to do it? And then, if we know what a chicken-and-a-half are doing in this length of time, what part of this can we attribute to the chicken? After all, we will have to answer a question about a chicken. Teachers want to tip the proverbial scale a little to overcome the stubbornness of inertia. And then, even if your instincts are finely honed, you have but a moment to get out of the way and watch students move right past you.

However, the moment a fifth-grade math class confronts a fraction, a catastrophe occurs. For this problem, it happened when students discovered that a good idea would be to determine how many times one-and-a-half fits into

twenty-one. The room inevitably filled with a collective groan, which always makes me sad, because if these same students had to find how many times three or seven fits into twenty-one, they could do it in the blink of an eye. I recognized several directions the problem solving could go: (1) I could remind my students that they had earned a neat trick when we worked on multiplying and dividing fractions. But if they had forgotten this trick already, how long would it be before they forgot it again? (2) I could ask them if they saw any relationship between one-and-a-half and three, but this is a pretty sophisticated way of looking at things, and I knew that unless students spotted a relationship on their own, they would not remember how to solve such problems again.

I chose option (3): I handed out boxes of Cuisenaire rods® (see **fig. 1a**). The miracle of these rods is that you get to call any rod you want *one* for that specific problem. If the red rod is *one*, we can call some other rod *one-half* (the white rod; see **fig. 1b**). I could make a train of twenty-one red rods. Then I would be able to measure the length of this train with one red and one white rod (see **fig. 1c**). How many times would this combination fit?

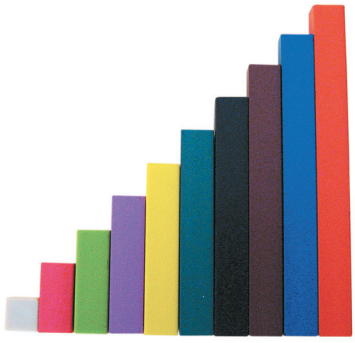
Step out

- *Which piece would be a good one to call* one*?*
- *If I call the white rod* one*, I would not have a piece to call* one-half.
- *The next rod in the Cuisenaire staircase is red. If I call the red rod* one*, is there a rod that I could call* one-half*?*
- *Which rods can I put together to show* one-and-one-half*? Is there a single rod that is exactly the same size?*
- *If we have settled on calling the red rod* one*, can you create a length of rods (a train) that will mean* twenty-one*?*
- *How do you suppose we could find out how many times one-and-one-half fits into twenty-one?*

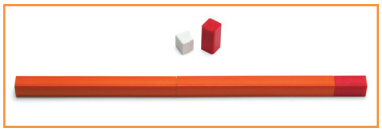
FIGURE 1

Students can call any Cuisenaire® rod *one* for a specific problem.

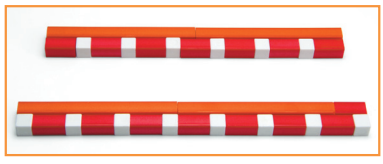
(a) A staircase of the rods shows the length of each color in comparison with the others.



(b) If the fifth graders were to call the second-smallest rod *one*, then they could put red rods together to make a length of twenty-one.



(c) Measuring a length of twenty-one by the *one* (red) rods and the *one-half* (white) rods allowed students to successfully multiply and divide fractions.



Step in

The room buzzed with the sound of children thinking aloud and busily at work. I heard words like *divide* and *measure* being tossed around. In a moment, we would be ready to revisit forgotten algorithms. And now it would mean something to these curious minds.

I reminded students of our class rules: We never shout out answers. Instead, we take a sheet of paper big enough that we will not lose it and write our name on it. Then we write our answer and anything we want to say about this problem. It does not have to be anything profound. I held up the problem box for everyone to see and then placed it back on my desk. "Remember, when it is time, put your paper face down. If you can see your name, you did it wrong."

When I picked up the stack of papers, I turned it over to see who had answered first, second, and so on. I decided which children had something to report to the class, and which children needed the encouragement that can be delivered only one-on-one. Every child must leave this problem with something. With a little luck, they would all feel proud and be willing to take on a new problem.

The children left my class just a little taller that day. As I watched them go, I acknowledged to myself that although my lesson may have begun with thoughts of my father and an old math problem, it did not end that way. Thirty-two sets of eyes and ears processed it, each child taking from it as much as possible of what he or she needed. The problem would continue on a miraculous journey, affecting everyone in its path. I considered what I had unleashed, and then quietly applauded myself.

One of my students returned for a book he had forgotten. His mother was waiting for him downstairs. As I unlocked the classroom door, he looked up at me with an odd look on his face and asked, "It was a trick question, wasn't it?"

"What do mean?"

"Well, there really is more than one answer."

"How do you mean?"

His face had a look of amusement. "Doesn't it depend on which half of the chicken you got?"

I thought, *Blessed are the literal among us. Their job is to keep us honest.*

He began laughing, finding his joke quite funny. I patted him on the head, "That was really funny. Thank you. Come on; I'll walk with you back down to your mom. Tell me what you liked about this lesson. I'm making a list of good ideas." My own thought was, *Ah, to be a fifth grader again!*

Step out

I was left with a pleasant quandary. How could I keep to the tradition of this kind of lesson—not providing an answer—and still

promote closure for the inexperienced teachers who would read my account? I decided, as you will see, to entrust this information to persons unlikely to tell.

Step in

So, Dad, in case you are still wondering how things turned out, I became an elementary school teacher, and then strangely enough, a mathematics teacher. I went on to instruct many college students as well. I grew to love what I did, and consequently, I continue doing it to this day. My favorite part is helping new teachers prepare to teach math.

If you run into Sam or Murray or Sidney—or even an arbitrary chicken—you could tell them that the answer is fourteen and that you have this on good authority. Every year, I connect with my students by convincing them that we are all working on this problem for the very first time. And each year, one of us is more surprised than the others by the very same answer.

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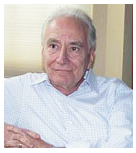

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