

## Is Elementary Education a Concern of MAA Members?

By Patricia Clark Kenschaft

Last year in a “nice” white suburban town a fifth grade teacher was observed drilling her students in adding fractions by adding across the numerators and then adding across the denominators. Is this teacher an outlier? I fear not. Some years ago I went to a fifth grade class in one of New Jersey’s wealthiest districts. “Where is one-third on the number line?” I began. All those friendly white faces fell to the floor, so I repeated the question. “Near three?” the teacher guessed. She is one of the highest paid fifth grade teachers in the country.

You can read about my adventures during seven years of helping elementary schools teachers mathematically in “Racial Equity Requires Teaching Elementary School Teachers More Mathematics” (*Notices of the AMS*, February 2005, also online at <http://www.ams.org/notices/200502/fea-kenschaft.pdf>). I was inspired by the teachers’ eagerness to learn and their ability to do so, but distressed at their lack of mathematical knowledge. The teachers had emerged from a flawed system.

Too often elementary school teachers teach incorrect “mathematics” and also communicate to their students that mathematics is too difficult for ordinary mortals. “If my teacher doesn’t understand this, I can’t either.” Such intellectual and emotional damage is so devastating that even a teacher who is mathematically competent will find it very difficult to undo. High school teachers and remedial college faculty must overcome much more than lack of knowledge.

It seems to me that the critical path toward improving our entire math education system is helping pre-service elementary school teachers *before* they damage children. Mathematicians may have some reluctance to teach these courses, based partly (justifiably) on the difficulty of doing so, but also (less justifiably) on the perceived lack of intellectual challenge.

One memorable semester, I taught three first grades each Wednesday morning, introductory calculus each Wednesday afternoon, and abstract algebra each Wednesday evening to graduate students. One evening I found myself saying, “When we were discussing this topic this morning in first grade...” The class roared in laughter, but I continued. The fundamental topics of abstract algebra *are* presented

in first grade! Furthermore, the pedagogical approaches that reached the children were useful for graduate students. After the final exam that semester, the graduate students stood around and one said, “I think we learned a lot more this semester because you were also teaching first grade!”

I eventually was able to teach pre-service elementary school teachers. Grappling with basic mathematical concepts with adults who don’t love math is very different from exploring them either with first graders or with graduate students. But they too can be enticed to reexamine concepts that they had been taught were “stupid questions.” I used Thomas Parker and Scott Baldrige, *Elementary Mathematics for Teachers* (Sefton-Ash Publishing, 2003, see <http://www.singaporemath.com>), a text accompanied by five Singapore children’s texts, and was quite smitten. There may be other fine teacher-preparation programs, but I know there is at least one.

Some teachers have told me that they are ordered by their superiors, “Teach only one method! More than one confuses the children.” It is hard to estimate the mathematical damage done by this widespread admonition. When elementary “mathematics education” consists of inculcating children with algorithmic skills, never to be questioned or varied, what does that do to citizens’ ability to think mathematically?

Another pernicious aspect of elementary mathematics education is key words. One widely used test-prep program advocates, “When you see ‘each,’ multiply.” Administrators claim that such drilling improves test scores. One Montclair State University student intending to become an elementary school teacher insisted that because American small trucks had an average gas mileage of 20 mpg in 1999 and sedans had an average of 28 mpg, altogether they must have an average of 48 mpg. She was a pleasant person who knew she was outvoted, but no matter how many of her classmates tried to explain why the average must be between 20 and 28, she clearly felt betrayed. “‘Altogether’ means ‘add,’” she kept saying, incredulous that she had been taught wrong all these years.

Persuading college students to abandon key words has

been more challenging for me than leading them to enjoy mental math. One actually said, “How else are you supposed to learn?”

Pre-service and in-service teachers *can* learn to think, even after decades of faulty teaching and administrative admonitions. Furthermore, they *want* to learn — in my experience, without exception. Once, after exploring the multiplication algorithm using base ten blocks, a teacher became angry: “Why wasn’t I taught this before? I’ve been a third grade teacher for thirty years, and I could have been *such* a better teacher if someone had let me in on this secret thirty years ago!”

Most memorable, perhaps, was a whole day that I spent with 28 Newark third grade teachers, two each from 14 schools. I changed the (math) subject every 40 minutes, and I’ve never had a more rapt class. After the first break they came to me with a question on a standardized third grade test “that none of us can answer. Can you?” I could and did. It was a combinatorics problem, reasonable for third graders but much harder after you have been taught never to *think* in a math context.

The Conference Board of the Mathematical Sciences (CBMS), an organization composed of 16 mathematical organizations, released *The Mathematical Education of Teachers* in 2000. It recommends that future elementary school teachers take four courses in mathematics: (1) number and operations, (2) geometry and measurement, (3) data analysis, statistics, and probability, and (4) algebra and functions. States are not hastening to adopt the CBMS standards as requirements for certifying teachers, and institutions of higher education are even less eager to mandate requirements above the states.

Wouldn’t it be great if American children emerged from elementary school either knowing algebra or ready to learn it? Children in some countries do. As I signed in at January’s Joint Mathematics Meetings, I noticed “Romania” on the nametag of the woman checking me in. I confirmed she had put her native country after her first name.

“Did you take calculus in eighth grade?” I asked, motivated by reports from two other Romanian immigrant desk clerks I’d met in the past two years.

“No, we had integral in ninth grade.”

“But you had differential calculus in eighth grade?”

She nodded.

I don’t want to suggest that we should model our education program on that of any other country, but wouldn’t it be nice if college math professors could teach only calculus and up? One prerequisite for this pleasant possibility is that our elementary school teachers learn the mathematics we want them to teach.

Members of the MAA are pivotal in remedying this situation, both politically in getting appropriate state requirements and professionally in providing willing, competent teaching. What can you do to help? 🍷

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Every bequest is a powerful expression of loyalty, their lifetime involvement, and their faith in the future of the MAA. We remember each of them fondly and with deep personal and professional respect.

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