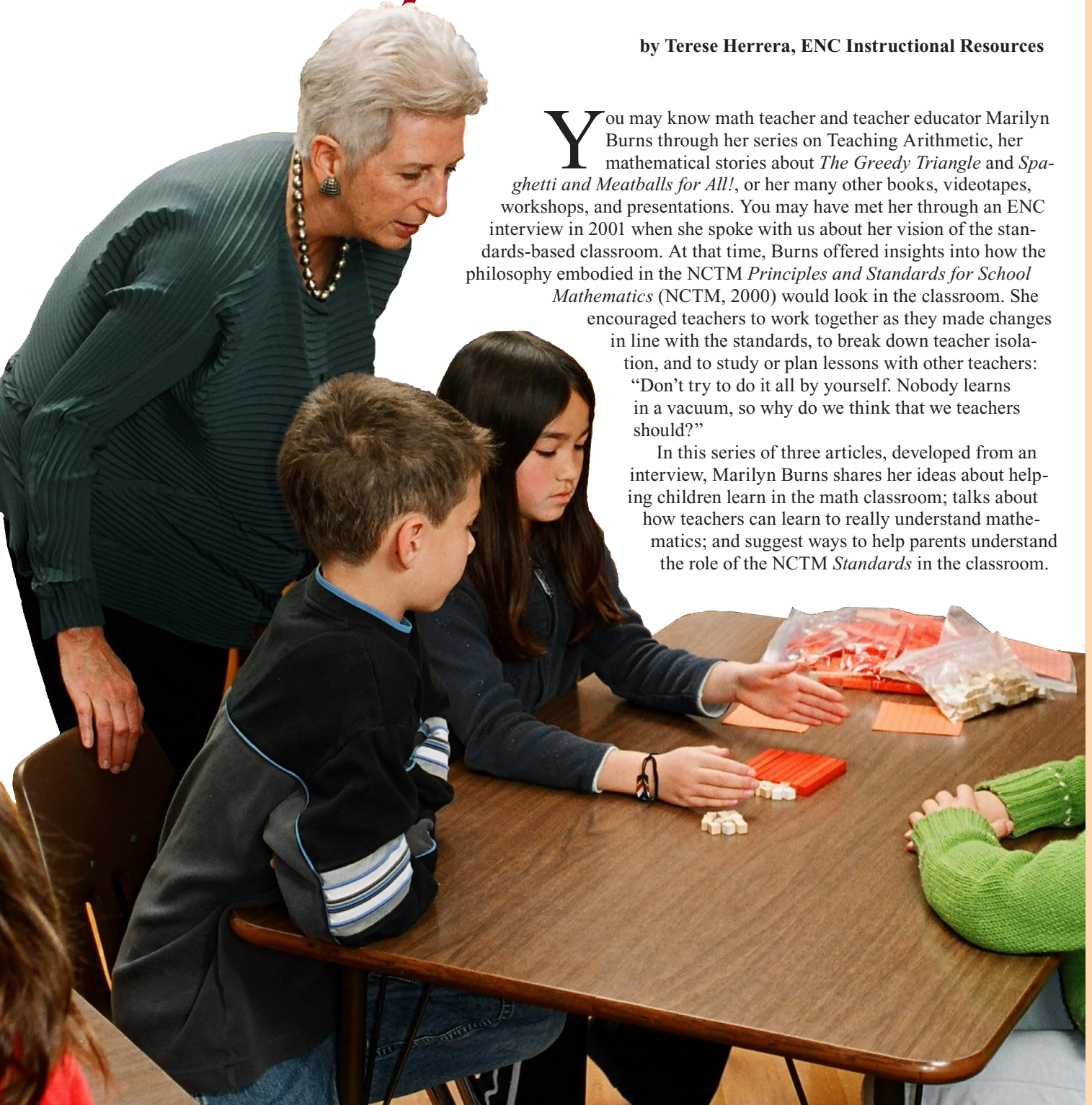


Marilyn Burns Talks About Today's Classroom

by Terese Herrera, ENC Instructional Resources

You may know math teacher and teacher educator Marilyn Burns through her series on Teaching Arithmetic, her mathematical stories about *The Greedy Triangle* and *Spaghetti and Meatballs for All!*, or her many other books, videotapes, workshops, and presentations. You may have met her through an ENC interview in 2001 when she spoke with us about her vision of the standards-based classroom. At that time, Burns offered insights into how the philosophy embodied in the NCTM *Principles and Standards for School Mathematics* (NCTM, 2000) would look in the classroom. She encouraged teachers to work together as they made changes in line with the standards, to break down teacher isolation, and to study or plan lessons with other teachers: "Don't try to do it all by yourself. Nobody learns in a vacuum, so why do we think that we teachers should?"

In this series of three articles, developed from an interview, Marilyn Burns shares her ideas about helping children learn in the math classroom; talks about how teachers can learn to really understand mathematics; and suggest ways to help parents understand the role of the NCTM *Standards* in the classroom.



Teaching Mathematics in the 2005 Classroom

What are the challenges that you see as important to teachers today?

One of the challenges that I see teachers face today is dealing with the pressure of scores on district and statewide tests. Teachers all want their students to be successful, but it seems that the pressure from high-stakes testing has increased. Accountability is important, for sure, but this challenge takes its toll when there isn't always sufficient alignment between the tests teachers are required to give and the standards or instructional programs that they are expected to follow and use. Teachers feel challenged when a mismatch exists between what they are expected to teach and how the students are being assessed.

Another challenge that I see teachers dealing with is how to provide help for those students in their classes who are having difficulty keeping up. A teacher's job is to meet the needs of all of the students, yet there are always students who struggle and need additional help. And in the higher grades, the spread is wider from the children who are least successful to those who are the most successful. Even when district and state tests are aligned with instructional programs and standards, the results from these tests don't help teachers address this problem. The data from tests aren't reported in a timely way for them to be useful; plus it's really not the purpose of these tests to provide information about how to help individual students. Still, teachers must find ways to meet all students' needs, and to do that they have to find ways to make assessment of what students are learning an integral and ongoing aspect of classroom instruction.

How can those children who are struggling to keep up be helped?

Typically, in elementary schools, children who need extra help will have access to a resource room with somebody to provide extra help. But it's also typical for resource teachers to be well-trained in language arts and not as comfortable or equally trained at helping children with their mathematics learning. Math intervention often starts by asking a child, "What is your homework?" But focusing on helping students complete homework assignments won't result in helping students fill learning gaps. These students need different approaches to learning math, approaches that can help them develop the understanding and skills they need.

I don't see schools adequately prepared to help the children who

are falling through the cracks in math. The burden on classroom teachers is enormous. They implement their instructional programs and address the standards, but as good a job as they're doing and as much as they care about their struggling students, they still have an entire class to serve and struggle themselves to find the time to help those students who aren't able to keep up.

What are your thoughts about what sort of intervention would be effective for these struggling students?

I've been thinking a good deal lately about how reading and math are alike and different. Both call for bringing meaning to the printed page. In reading, we call this comprehension and in math, we call it sense making. When you're reading a book, however, if you can't figure out what a word is, it's most often still possible to continue with the story, making sense from the context or the pictures or both. I often have the experience myself when I'm reading of not knowing the exact meaning of a word, but I just keep on reading and am able to pick up the gist of what's going on. I don't think the same is true about math. If you don't understand one step in a procedure or one aspect of a problem, you can't just continue on and be successful. It's as if you fall off a ladder and have to start climbing again from the bottom rung. I think that's what it's like for students who are struggling. They miss something that is essential to their learning success, and their progress is stopped.

These students need more time and attention than they receive during regular class instruction. They need their learning to be paced in a way that allows them to keep up. They need help with breaking down the concepts, without dumbing them down. They need other ways into the mathematics, perhaps even the same questions but in different settings, and a slower pace so that they have time to practice. What's called for is skilled intervention. But how can a classroom teacher serve these students?

In order for teachers to make the time that's needed to work with the strugglers, they must be able to engage the rest of the students independently.

One way to do this is to have a list posted of choices of mathematical activities, games, and explorations. There are many games available that involve children in using the arithmetic skills they are learning while also giving them the chance to think strategically. Also, there are activities suitable for repeat experience merely by changing the particular numbers involved. When students finish an assignment early, they choose anything from the list. This keeps the children who work more quickly meaningfully engaged, and opens up the possibility for teachers to sit down with those students who need extra help—to offer them a different approach with a different pace and to give them another chance.



Is there anything more you would like to say about facing these challenges today?

We all need to focus on making the world better for children mathematically. And we need to keep the goal in sight: Children need to learn to think, reason, solve problems, and, at the same time, develop an appreciation of and an interest in mathematics. Without this, students' mathematical futures will always be limited.

Increasing Teachers' Understanding of Mathematics

How can teachers acquire the necessary math understanding they need to help students?

I think that professional development is the key, whether it comes from attending conferences, participating in workshops, watching and analyzing videotapes, or learning with their colleagues at their school. Also, there are opportunities for learning from the instructional materials that they are using. And, of course, we always learn from the students we teach.

A major goal of professional development should be for teachers to learn how to teach for understanding, so that students have a foundation of mathematical knowledge on which to build. This isn't always easy for teachers, especially if they were taught themselves in ways that focused on learning skills, rather than developing understanding. For example, think about multiplying fractions, a skill that's important not only to elementary arithmetic instruction but also later in algebra. It's easier to teach a student the procedure for multiplying fractions—you just multiply across the tops and across the bottoms—than to teach a child to make sense out of why multiplying the numerators and denominators produces the correct answer. Teaching the “why” requires that teachers themselves have thought deeply about multiplying fractions.

For teachers who haven't thought about this, or about other math concepts, a problem is that there is no way for them to learn what they need to know about the math they have to teach. The mathematics that is the underpinning of the arithmetic we teach isn't taught at the university level. I have a dream of a university course called “Arithmetic 101” that helps teachers learn by asking questions about aspects of arithmetic that we may not have thought about but are important for helping students. For example, why do we always get an odd answer when we multiply two odd numbers but an even answer when we multiply an odd times an even or two even numbers? What about odd and even for addition? Is zero odd or even? What about fractions: Can they be odd and even? Why does “canceling” zeros in the fraction $10/20$ produce an equivalent fraction, but not in the fraction $101/201$?

When teachers are asked to think deeply about how to multiply one fraction by another fraction, they may wonder, “What's the point of understanding that when students are tested only on the answer to the problem?”

To value teaching how to compute answers without also helping students understand the underlying mathematics is a shallow response to what education is about. This can be said about any subject, not just mathematics. Education should imbue curiosity and a love of learning. We want children to think and reason and solve problems in all areas of life. If the only reason we are studying a topic or asking a question or doing an exercise is for the test, it doesn't make sense. Teachers also have to sell why it is important. We have to encourage the curiosity in students to understand, and then give them the wherewithal to get there in every area and in every subject.

Back to multiplying fractions. We could say that maybe teachers should just get on with it and teach the procedure, that maybe the “why” really isn't very important. But I think it is important. Students should seek to think, reason, and make sense of all that they do, and the pursuit of making sense should be part of all of their mathematics learning. One way to think about multiplying fractions is through understanding how multiplication relates to the area of rectangles. The first time I proved to myself after sketching a one-by-one rectangle why one-half times one-half had to be one-fourth, I said, “Wow! I see it now.” And that happened many years after I had become a teacher. Nobody had ever said to me before: Think about it this way.

Do you have other ideas about what teachers could do now to develop this knowledge they need?

I've belonged to a reading group for years, and recently I thought to myself, “Why don't I have a math group?” What would we do? We'd meet and solve math problems together. Would teachers do that? It is a hard sell, I realize.

Maybe an easier sell would be to have a math group that focused on student learning and the math curriculum. A young colleague of mine is a math coach in a K-6 school. She asked the teachers, in grade-level teams, to agree on a class assignment that would give evidence of something that was important for children at their grade level to learn. After they had their students do the assignment, they pored over the papers and chose a few examples of good student work. My colleague organized a bulletin board in her office with space for each grade level to post the work they chose. Then they looked at the samples from all of the grade levels. For the first time, set out through the children's work, the teachers were able to see examples from the entire K-6 curriculum. She said it was a really worthwhile experience.

Why are some teachers uncomfortable teaching math?

In general, elementary teachers have more training in reading and language arts, both in assessing children and thinking about the teaching, than they do in math. How can they become more comfortable teaching math than they are now? Teachers are creative and excited when they teach reading and language arts, but the classroom often gets very

serious at math time. I'm looking for the rigor and seriousness for sure, but I'm also looking for those qualities of creativity, wonder, and excitement that teachers have told me they experience when teaching reading and language arts. Teachers are more cautious about teaching math. In reading, they feel that they know the standards to meet and have ways to provide instruction that meets them. In math, however, many teachers don't have that confidence. We need to take these two most important areas of the curriculum—reading and math—and look at them side by side to see what we can learn from one to enhance the other.

Connecting Parents with the Math Standards

Some teachers say that parents' demands for their children's math learning aren't consistent with what their children are experiencing in the classroom. What are your thoughts on this?

I think that some parents don't understand or are confused by what their children are doing and learning in math. I chatted with a woman last summer who told me about her third grader coming home with so many different ways to solve multiplication problems. For the problem 6×7 , she told me, her daughter might first multiply 6×2 to get 12, then add three 12s to get 36, and then count on six more to get 42. Or she might start with 6×5 , which she knows is 30, and add on 12 more to get the answer. I asked her how her daughter felt about her math learning. She said that her daughter loves it. "But shouldn't she just know that 6×7 is 42 and not have to go through all of this thinking?" The woman was concerned.

I talked with her about how wonderful her child's thinking was, how it showed her ability to reason mathematically, how this ability would help her when she had to tackle problems with larger numbers, how memorizing didn't always engage thinking, etc. The woman was reassured by the information I gave her about what was important and valuable for her child's math learning. She hadn't realized how impressive her third grader's reasoning was and how much depth of understanding it showed. Rather than delight in her child's thinking, the parent's reaction was, "This is so different from how I remember learning math, and I don't feel comfortable." This reaction can then evolve into, "I don't think that my child is getting what she needs."

It's important to engage parents and provide information about the goals of *Standards*-based math teaching so that they realize that both understanding and skills are addressed in the classroom. Parents must understand that the key to *Standards*-based math teaching is for students to make sense of all that they are learning, just as comprehension is key to their children's reading proficiency. Making sense is the basis of mathematical success.

Children's assignments today are often very different from what parents experienced in school. We need to help parents see the value of *Standards*-based approaches to learning math so that they understand their value and can be supportive to their children.

Ways Parents Can Do Math with Their Children

- Each evening, empty your change purse or pocket of coins and, with your child, figure out the total value of the money.
- When you are going to the movies or to an appointment, have your child figure out what time you need to leave to arrive on time.
- Let your child see you doing math—measuring ingredients when you're cooking, making change when shopping, keeping score for a game, measuring plant food to feed your houseplants, and so on—and talk aloud about how you're reasoning.
- Cuddle up with your child and read aloud children's books that have math themes, then talk about the ideas in the stories. (Ask your librarian for suggestions.)
- Realize your influence on your child's math attitude. Make numbers accessible in game-like, light-hearted, playful ways. Let your children know that math is just another aspect of life and is not to be feared.

How would you advise schools to improve communication with parents about math?

Parents care deeply about their children's education and when there's an aspect that they don't understand fully—in this case, their children's math learning—a problem can arise. At the root of the problem, I think, is communication. It's essential to help parents understand what their children are learning, and how, especially since classroom practices today may be very different from what parents recall from their own learning.

For example, "Ours is not to reason why; just invert and multiply" does not cut it in a world with the increasing complexity of problems that children will face. We have to help parents understand that computation by itself is not enough, that their children need a broader view of the basics and must also learn to think, reason, and solve problems. We can work toward increasing parent understanding by listening to their concerns, then helping them see why thinking, reasoning, and solving problems are important. We need to give them information about the purpose and expectations of assignments and what sort of help is appropriate for them to give their children. We need to give them ways that they can support their children's school learning by doing mathematics with them at home. Communicating with parents is essential.

Reference

National Council of Teachers of Mathematics. (2000). *Principles and Standards for School Mathematics*. Reston, VA: Author.

Terese Herrera is the mathematics resource specialist at ENC. Her career includes 15 years of teaching mathematics at the middle school and high school levels. Email: therrera@enc.org.