

An Interview with Marilyn Burns

Meeting the Standards—Don't Try to Do It All By Yourself

An internationally renowned educator describes ways to make educational standards come to life in your classroom.

by Terese Herrera, ENC Instructional Resources

A mathematics teacher and a teacher educator, Marilyn Burns is uniquely able to connect the philosophy of the Standards of the National Council of Teachers of Mathematics (NCTM) to classroom teaching and to students' experiences in learning mathematics. She has spent years communicating her love of math and her love of teaching through workshops, presentations, articles, books, and videotapes, for students as well as teachers and parents.

You may know Marilyn Burns best as the author of *The I Hate Mathematics! Book* and *The Greedy Triangle*, or you may be most familiar with her books for teachers, such as *About Teaching Mathematics: A K-8 Resource*, *Writing in Math Class*, and the Math by All Means series. Her most recent book, *So You Have to Teach Math?*, offers sound advice for both new and experienced K-6 teachers.

ENC is grateful that she agreed to be interviewed on the topic Teaching in the Standards-Based Classroom for this issue of *ENC Focus*. Please note that at the beginning of our conversation, we agreed that, in general, the standards we were discussing were *Principles and Standards for School Mathematics* (NCTM, 2000), and that "Standards-based" refers to the vision of teaching and learning in that document.

What would a Standards-based classroom be like?

The essence of a Standards-based classroom is this: Everything you do with children needs to help them make sense of the mathematics they are learning.

A lot of mathematics that I learned in school, such as dividing fractions and using the square root algorithm, was very mysterious. I finally made sense out of it by pursuing mathematics in later studies, but I don't think that the instruction that I received as a child was always with the intent that I was supposed to do only what made sense to me and persist until I understood.

I think the bottom line is: Does a child need to think and reason in order to be successful? Or can a child be successful by repeating something that he or she learned by rote? If the first is true, to me, the classroom is moving toward the Standards-based. But if children can be successful without necessarily understanding, then I think that it is violating the very essence of the Standards.

The goal is to get kids to think, reason, and be able to

apply their understanding to solve problems. Being able to solve problems is obviously the test of whether or not you understand something. The content of mathematics is important, but it needs to be taught from this basic premise.

What are your ideas on how to make a classroom, at whatever grade level, a place where students use sense-making as their basic learning strategy?

First of all, in planning instruction a teacher needs to look at the content and say, "What is it that I want my children to understand?" and secondly, "What is it that I want them to be able to do with that understanding?" It is really a question of both concepts and skills.

Teachers first need to have a sense of what the content is, and that's outlined in the five content standards. Then the next thing, the question that I always ask myself, is: "What experiences can I provide the children that would give them a way to start to make sense of this for themselves?" This is where I look at the process standards because they really address what children need to do to learn math—

- Problem solving—What kinds of problems can I present to children that would give them a chance to grapple with important ideas and skills?
- Reasoning and proof—What kinds of situations can I pose to children so that their reasoning is engaged and they have experience giving convincing arguments?
- Communication—How do I involve children in talking and writing to help them communicate what they are studying and learning, and hear the ideas of others?
- Connections—How do I help children see the connections among mathematical ideas rather than seeing concepts as isolated and separate from one another?
- Representation—How do I help children use the symbolism of mathematics to describe their thinking?

When I am planning new experiences for children, I use those five process standards as my guidelines. I say, "Am I providing kids the opportunity to problem solve, reason/give proof, communicate, connect, and represent?"

But there is another thing I think about, and this has been the biggest change for me in the last five to ten years. Teachers often say to me, "Children are supposed to understand, but is it okay to tell them something? How do I teach it?" One criticism that I frequently hear is that in reform math teaching there is no direct instruction.

But, of course, there is direct instruction. I make the dis-

tion this way: I ask myself when teaching something new, "Where is the source of the knowledge for the child—inside or outside?" Mathematical concepts and skills rely on logical structures and learning them calls for making sense of these structures, so the source of learning is internal. But social conventions are also part of learning math, and the source for learning the conventions is external and can be another person, a book, television, or some other source outside the child.

Let's say, for example, that I'm teaching the signs for "greater than" and "less than." You can't figure out the sign—it's just a funny-shaped arrow. So it's appropriate for the teacher to teach this by telling.

But if I want to teach a child how to figure out if five-eighths is more than or less than or equal to a half, the child needs to make sense of these fractions, not merely memorize them or learn a rule, like "cross multiplying," that they might not understand. The source of that



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understanding is inside the child's head.

To me that is the critical difference about a *Standards-based curriculum*—it makes the distinction between when you teach by telling and when you teach by giving children experiences to grapple with. The issue is—where is the source of the understanding for the child?

Some teachers tell us they feel overwhelmed by high-stakes testing. What are your thoughts on that issue?

I am not against tests. How else do we know how well we are doing? There has to be some accountability. Accountability that has some standardization makes sense because how else do I know that I am implementing the program that I am supposed to be implementing?

But when I see standardized, norm-referenced tests used for this purpose rather than standards-based, criterion-referenced tests, it makes my heart sink. In a norm-referenced test, you know that half of the children are going to be below the fiftieth percentile. It's like being graded on a curve in college, and I always thought that was grossly unfair. It just seems crazy to me that somebody is going to have to fail and someone is going to do well, and all students have to spread out in a particular distribution.

For example, as a standard, I would like to have every fifth-grader know the multiplication tables and be able to find the answer to multi-digit multiplication problems with accuracy and efficiency. It's possible that, on a criterion-referenced test, anywhere from 0 to 100 percent of the fifth-graders in our country would reach that standard. In this example, the standard is clear and there is the possibility for everyone to do well.

As teachers, we're not learning from most of these standardized tests, either about our teaching or about how to help our individual students. The tests too often give more pressure than help. I'd like to look at tests in a positive way, as a vehicle for me to improve my teaching and learn how to help children learn. I'd like a test that asks children to apply the understandings and skills that they are learning to problem situations.

At times I think about Mozart and Einstein. How would one test reveal the brilliance each possessed?

My biggest testing dream is to have ten problems on a test and say to a child, "Pick any seven and show your stuff!" Of course, that is pie in the sky, but short of that, I am not even against multiple-choice tests as long as students have to read and reason rather than perform things they learned by rote. If they have to read and reason on the test, then teaching to a test means everything that I do in class has to do with reading and reasoning, which are life skills in every subject area. In that situation, preparing for the test would go on all year rather than occur in a month of drilling the kids.

In some middle schools that I visit, students almost seem to resist learning, or to be focused on whatever can distract them and get them off task. It becomes very hard for teachers in those schools to do what I'd call "really teach."

What would you say to them?

One realization that I've come to from visiting and teaching in many schools is the importance of the school leadership in setting the tone of learning in that school. The school principal is the key. In a school that functions well, the principal is a strong person who supports learning and insists that all the children are there to learn.

I can tell in a minute when I go into a school if the principal is one who pays attention to instruction or one who is so overwhelmed with the details of administration that he or she can't focus on the learning going on. Without the principal's support, nothing is going to happen in a school. An individual teacher may be innovative, but a school community is necessary to improve learning. As math educators, we haven't helped our principals understand what the goals are mathematically.

Middle school, in particular, can be toxic. I think it's a tough time of life for students. There's the socialization issue, which affects how they view mathematics. If math were seen as something "cool" rather than something for eggheads, kids would want to be part of it, but it's a really tough sell.

Also, at the middle school level you have departmentalization, so the question is how do you keep the staff from going off into their corners, and instead, encourage them to say, "How do we work as a community to support these children?" What do you tell a teacher who is struggling in this culture to do his or her best? You say, "Find your own professional community of support. Don't do it alone; you can't. None of us can do it alone."

What would you say to people who work in professional development, who present workshops or are teacher educators, about helping teachers be better math teachers?

I think we can't emphasize too much that you cannot teach what you don't know. Therefore, mathematics has to be at the basis of all that you do and the vehicle through which staff developers talk about pedagogical issues. I think the five process standards are important, but I worry that we spend too much time talking about the processes unrelated to the mathematics.

When you are working with preservice teachers, it is sort of hard because they have no classroom experience to ground their learning. The best you can do is strengthen their understanding of the mathematics that they have to teach and do so in a way that changes their notion of what the classroom might look like. Because we know people teach as they were taught, you have to teach preservice teachers in a way that you want them to teach and you have to help strengthen their mathematical understanding.

In working with inservice teachers, everything should be tied to what the teachers can actually try and implement in their classes. They really should have a chance to experience what they are learning with their own students.

Do you have suggestions for ways to improve the content knowledge of teachers?

I have this dream that will probably never happen: Oprah, Jay Leno, and Dave Letterman would do math problems on their shows and talk with their audiences about mathematics in ways that can promote interest and understanding. A cultural shift of that proportion is needed. Math should no longer be seen as something for the “haves” but not the “have-nots,” interesting to eggheads but not accessible to others.

Another avenue for addressing content knowledge is through teachers’ own textbook materials. When confronting a topic that they are not comfortable with in their teaching, they can learn from those materials. In some of the reform curricula, teachers will find mathematics explained in a way that can help strengthen their own understanding.

And I would love to see more kinds of learning available to teachers about mathematics, in ways that weren’t frightening. I know teachers who are terrified to go back to their local college. What courses would they take there? The mathematics courses that are offered in colleges and universities typically have little to do with what elementary teachers have to teach. I’d love to see, for example, math courses available to teachers that would really help them understand the arithmetic that they have to teach.

Here is a question from arithmetic that I had never thought about before Suzanne Chapin and Art Johnson raised it in their book, *Math Matters*. When you look at a fraction, can you predict whether its decimal form will repeat or terminate? Also, some fractions just repeat, like .333...; others repeat in a form like .1666.... How do you know? How many numbers will be in the part that doesn’t repeat? What about the numerator and denominator of fractions can give you information? In the eight years I taught eighth grade, it never occurred to me to think about that, and therefore it never occurred to me to talk with my students about these ideas. It was a lost opportunity.

Also, in none of my university math courses did those questions get raised, probably because they were considered too “elementary.” We just assume teachers understand these elementary topics. And teachers of young children feel, “Well, I only have to teach sums to 20,” but the essence of what they are teaching children to do in terms of taking numbers apart and putting them together is more than learning the sums to 20.

So in my dreams, we would have math on Oprah and Leno and Letterman, and the public would stop making math the butt of bad jokes. We would have good enough curriculum materials to help teachers learn math. We would have access to courses, in colleges and universities or online, where teachers could study in depth the math they have to teach. It is hard to imagine a course in arithmetic as a graduate course, and yet I think it is worthy. The course would be taught in the spirit of the *Standards*, where problem solving, reasoning, proof, communications, connections, and representations are the essence of the course even at the college/university level.

Please share any other thoughts about this topic—the Standards-based math classroom.

The *Standards* document is large and daunting, but I encourage teachers, when they are preparing to teach something, to take a look at what the *Standards* offer. The more that you think about a topic you will teach, the better prepared you’ll be.

And, as I said before, you can’t make changes by yourself. When I go into somebody’s classroom, it’s wonderful for the two of us to talk about the children and the lesson. We are too often isolated as teachers. Whatever teachers can do to break down that isolation—studying with another teacher, or talking with the principal about visiting other classrooms, or finding time to plan lessons together—can help. Don’t try to do it all by yourself. Nobody learns in a vacuum, so why do we think that we teachers should?

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