

Beyond Answers: Exploring Mathematical Practices with Young Children

By Mike Flynn

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Each chapter is dedicated to a different practice. Using examples from his own teaching and vignettes from many other K–2 teachers, Mike does the following:

- Invites you to break the cycle of teaching math procedurally
- Demonstrates what it means for children to *understand*—not just *do*—math
- Explores what it looks like when young children embrace the important behaviors espoused by the practices

The book's extensive collection of stories from K–2 classroom provides readers with glimpses of classroom dialogue, teacher reflections, and examples of student work. Focus questions at the beginning of each vignette help you analyze the examples and encourage further reflection.
Beyond Answers is a wonderful resource that can be used by individual teachers, study groups, professional development staff, and in math methods courses.

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Editorial Review

Review

“Anyone curious about children’s mathematical creativity and the potential for math exploration in the classroom will enjoy reading this accessible book.” –Deborah Schifter

Most mathematics curriculums give a place to the "process skills" of the subject. When the first English national curriculum was unveiled in 1989, its "Attainment Target 1" was "Using and Applying Mathematics"
"Pupils should use number, algebra and measures in practical tasks, in real-life problems and to investigate within mathematics itself."
Successive incarnations of the national curriculum had similar sections or statements. Problem was, we tended not to turn to this bit. It was the more particular 'add two two-digit numbers'-type statements that we turned to on a week-by-week basis. Why? Maybe the process skills are, when expressed this way, too general, too all-pervasive; it's easier to turn to the more specific, to the 'know the names for various kinds of triangles' sort of requirement.

But the process skills are where the mathematics really happens!

In the US, the Common Core State Standards for mathematical practice are:

- Make sense of problems and persevere in solving them.
- Reason abstractly and quantitatively.
- Construct viable arguments and critique the reasoning of others.
- Model with mathematics.
- Use appropriate tools strategically.
- Attend to precision.
- Look for and make use of structure.

I suspect there will be the same tendency to pass quickly to the more week-by-week standards. And yet these skills are the core of what it is to work mathematically. What to do? How to make 'reasoning abstractly and quantitatively' less nebulous-sounding?

Enter Mike Flynn's book *Beyond Answers*.

Mike devotes a chapter to each of the mathematical practices. He begins each with a personal experience. This is useful in a number of ways. One, it's good to get to know the author of a book you're reading. It somehow makes the exchange more on the level, more real. Two, he gives an analogy for the practice from his own experience. I like analogies; they work well for me, and I guess they do for other people too. They ground the practices in our everyday non-mathematical experience.

For instance, in the introduction Mike talks about getting lost in Boston, a town he wasn't that familiar with, and how his brother helped him to learn to navigate the city without helping him too much, by asking

powerful guiding questions.

I like the metaphor in lots of ways. For one, mathematics is like a city, with links criss-crossing it in all sorts of ways. Also, navigating is a primal kind of function for us, one we share with animals, whether hunting or fleeing, patrolling or harvesting. I blogged about the link for me once. The book is about how we help students to navigate for themselves, developing skills to find their way round, to become at home in the world of mathematics.

Another thing I like about the book lots is that it gives us a lot of classroom vignettes that exemplify teachers enabling their young students to develop the standards. It's an approach that's worked well in a number of great recent teacher education books, because we learn by concrete example more than by definition.

There can often be just one adult in the classroom, me, the teacher, and though we learn so much from the students themselves, how do we get to learn from other adults? Well, these kind of vignettes let us peek in at key moments, listen to an actual conversation, catch how adroitly the teacher puts themselves to one side while she allows ideas to come from the students rather than her.

There's a consistent emphasis on student voice in the book. 'The benefit of taking extra time to discuss their strategies is that it allows ideas to come from the students and not from me. That means they have opportunities to hear mathematical arguments from their peers and to critique their reasoning (MP3). It also helps to create ownership of the ideas and changes the power structure in the classroom by showing that we all contribute to the learning in math class' (p123).

It's important that we think about the big picture of what we're doing in mathematics lessons, and how it links ultimately with what we do in the adult world, and Mike takes time to spell out the essentials of each mathematical practice.

In the chapter on MP 4, *Model with Mathematics*, Mike discusses one of the essentials of modelling, the process of abstraction.

Abstraction is an essential tool way beyond the maths curriculum, as I've mentioned in a post before, but Mike helps us see how it's there in so many of the simple tasks we give young children.

He gives the example of a first grade class who are asked to make representations of who sits at their tables (p84). They show it in lots of ways:

The students are learning to ignore, for this task, the myriad other important features of the situation, the appearance and personalities, how they're relating and feeling, what their position is in relation to each other, and just to focus on number and one category, boy/girl. This narrow focus, ignoring most of the context, is something young students learn through practice.

You can see how this process works with adult mathematical modelling, how for instance a traffic planner ignores all sorts of context in traffic, car colour and make for instance, to mathematise the situation, focusing on numerical data such as number of cars and speeds. Once she's represented the structure of the network of roads and the numbers she needs, she doesn't for a while need to think about them as roads or cars as such. After calculating possible solutions, she can then translate them back into road locations, numbers of lanes,

traffic capacities and suchlike, and ultimately actual road construction can begin.

Young children learn to do essentially the same thing. Mathematising is there all the way. When we count a handful of pebbles, for a short while we attend less to colour and texture, to shape and size. Or, if we sort by shape, we might ignore all the other features.

The three-act task, as Mike says, is a really useful tool for helping students to mathematise. Graham Fletcher's great collection is a great introduction to this, and one I've just been sharing with teachers in Qatar.

In Chapter 5 (*Use mathematical tools strategically*) Mike lists examples of tools in five categories: supplies, manipulatives, representation tools, digital tools, and mathematical tools. I was particularly interested in the discussion of the last, also called 'thinking tools'. As he writes (p111), 'A large part of our work with MP5 developing and supporting our students' metacognition.' We've all had students that when asked, 'How did you know that?' answer, 'With my brain'! Helping students to recognise how they're actually thinking, in detail, is such a wonderful part of what we do, and Mike gives attention to this, with plenty of great examples and vignettes.

I loved 'Are there any other foxy shapes?' in chapter 6 (*Attend to precision*). On p133-6 three's a great vignette of how children play a game sorting shapes according to some property they've chosen. (This would make a great development from a Which One Doesn't Belong!) One student's category is 'foxy shapes' and the Socratic way in which the teacher shifts the children from a sort of holistic recognition of a fox-faced shape to themselves giving it a precise definition of essential properties is a delight.

I realised that I'm probably an MP 7 guy (of course all of them are important!) - someone that spends a lot of time in class getting students to explore and search for structure. I'd not seen such a complete list of the sorts of mathematical claims young students might make; is that kind of thing out there widely, because it should be? I do less problem-solving (learning to do more!) but focus on this lots.
I've merely touched on a few features of the book. There's so much more in there. It would be an excellent introduction to what's important in mathematics education for any beginning teacher of five to eight year olds. And an excellent tool for reflection for an experienced one too, bringing the focus back again and again to students' reasoning and discussion.

As Mike says, 'Enjoy these moments with your students and cherish the opportunities to learn alongside them, for this work is as engaging for us as it is for the students.'

Simon Gregg's Follow Learning Blog

An important thing to know about the Standards for Mathematical Practice is that they pertain across all levels of mathematical activity. These are K—12 standards, but they describe the kinds of activity that distinguish math as a discipline.

When I wrote about the Standards for Mathematical Practice on this blog, and in the Dummies book, I took the easy way out. I addressed their spirit without going into all eight of them in depth.

But I'm here today to tell you that Mike Flynn has taken the high road and done the much more challenging job of treating each of these standards right.

Flynn structured his book *Beyond Answers* around the Standards for Mathematical Practice—one chapter per standard. He illustrates each with a vignette from his own life demonstrating the utility of the practice in his own daily life, with vignettes from classrooms, and with clear writing demonstrating the very real and important mathematical work of which young children are capable.

On its surface, this is a book about elementary children doing mathematics. But it's really a book about *people* doing mathematics. If you're a secondary or post-secondary teacher, and you read this book without seeing important connections to the work that you do, I'll buy you a cup of coffee so we can talk about that.

Ultimately, my own critique of the SMP was about them being too numerous to remember, and about them overlapping in ways that make it difficult to communicate their individual importance. I still have those critiques. Flynn doesn't convince me (nor does he try) that this is the perfect set of such standards. But he doesn't need to do that.

These are the standards we have. They resonate at all levels of mathematical activity, and in *Beyond Answers*, Mike Flynn shows convincingly that young children's mathematical work is not fundamentally different from that of older students. Mathematics as an intellectual discipline is alive and well.

Christopher Danielson's Blog

About the Author

Mike Flynn is the director of Mathematics Leadership Programs at Mount Holyoke College and runs the Master of Arts in Mathematics Teaching program. Prior to this work, he taught second grade at the William E. Norris Elementary School in Southampton, Massachusetts, for fourteen years. He is the 2008 Massachusetts Teacher of the Year, a recipient of the 2009 National Education Association Foundation Horace Mann Award for Teaching Excellence, and a 2010 recipient of the Presidential Award for Excellence in Mathematics Teaching.

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