



The Early Math Project

Peabody researchers evaluate a comprehensive math curriculum for the pre-K set

BY Lisa Robbins

PHOTOGRAPHY BY John Russell

If you find it hard to imagine four-year-olds discussing their understanding of mathematical concepts with each other, try a visit to Mitzi Riley's classroom. Riley teaches at Buena Vista Elementary Enhanced Option School, in the Metropolitan Nashville Public Schools.

On a recent Friday morning, Riley's pre-K class hums with cheerful energy. They have just played "Blast Off!", counting backwards from 10 as they coiled their bodies in imitation of rockets set to launch. Now the children sit at centers dotted around the room. Riley sits with several students playing a numbers game called "What Card's Missing?" There are 10 cards, each turned upside down, so the children have to use their "x-ray vision" to guess which number Riley has removed from the lineup. At one point, Riley turns to tend a student who walks up with a request. The students at the table continue the game without her, with one child asking another, "What card's missing?" When the second child answers correctly, his partner then asks, "How do you know?"

"Because that's what comes between 6 and 8," the child replies.

"Kiss your brain!" his partner exclaims.

The children's ability to verbalize their reasoning and their willingness to chat about it are striking.

Research has found that, while early reading ability predicts later reading ability, early math learning predicts not only stronger math skills later on, but strong literacy and reading skills as well. In other words, as Douglas Clements and Julie Sarama write in the February 2008 issue of *Teaching Children Mathematics*, "Mathematics is a general cognitive skill."

In their article, Clements and Sarama also cite research showing "that early geometry work leads to higher mathematics achievement, higher writing readiness, and higher IQ scores in the primary grades."

Clements and Sarama, on the faculty of the SUNY-Buffalo, have developed a pre-K math curriculum designed around two core domains, numbers and geometry. Riley's class is part of a four-year research project, led by Peabody education and psychology Professor Dale Farran and her colleague Mark Lipsey, director of the Vanderbilt Institute for Public Policy Studies' Center for Evaluation Research & Methodology, that is evaluating the "scale up" of this new curriculum away from the influence of its developers. Fifty-seven Nashville Head Start and public school classrooms, including the control classrooms, participate in the study. (The developers are leading testing of the curriculum in Boston and Buffalo.)

Mitzi Riley, a pre-K teacher at Nashville's Buena Vista Elementary Enhanced Option School, watches as two of her students play "What Card's Missing?"

“Blast Off!” teaches the pre-K students number skills, one of two core components of the math curriculum (the other being geometry) called Building Blocks that is being evaluated by Peabody’s Early Math Project.



This comprehensive pre-K curriculum, called Building Blocks, is the first year of a broader curriculum that extends through second grade. It provides teachers with a year’s worth of week-by-week lesson plans, constructed around young children’s developmental learning trajectories. For each trajectory, there is a series of activities. The first is dubbed

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—MITZI RILEY

the “whole group” activity, which the teacher does with the entire class. The others include a “small group” activity, led by the teacher during center time; a related hands-on activity that children do on their own in a small group setting; and a computer game specifically designed for the lesson at hand that allows the students to explore individually what they are learning. In addition, every week, parents receive a letter about what the children are learning in class, with suggested at-home activities.

“It’s a great system of reinforcement,” Riley says. “It’s user friendly, child friendly and developmentally appropriate. It uses lots of manipulatives. I’ve really enjoyed it, and the children enjoy it. Our play is our work, and our work is our play.”

Farran, too, is enthusiastic about the curriculum’s potential.

“The activities are developmentally aligned with how children understand mathematical concepts,” Farran says. “It allows them to build on their intuitive understanding of math, and to build on it in a complex way in the future. It asks questions like, ‘How did you do that?’ and ‘What makes you think that?’—encouraging them to explain the concepts for themselves. Kids are delighted to get a chance to talk, and it solidifies their conceptual understanding.”

The curriculum is not without significant challenges. The developers use the term TRIAD (Technology-enhanced, Research-based Instruction, Assessment and professional Development) to describe their approach. Farran’s research already has found that it will require a high level of teacher skill in classroom management.

For Farran and her researchers, a major challenge in implementing the study was crossing what Farran calls the “enormous digital divide.” They obtained supplemental grant money in order to provide two computers per class and to wire classrooms for Internet access. (In some cases, this required wiring whole buildings.) The Building Blocks curriculum comes in traditional printed form and on disc, but its full array of tools works best via its easily updated online version. It offers teachers information about each learning trajectory, descriptions of class activities—

complete with videos of children and teachers demonstrating the lessons—links to reference articles, and even the ability to share feedback with the curriculum’s developers. In order to take full advantage of these resources, teachers will need to feel comfortable using computers.

Farran and Lipsey’s study also includes facilitators charged with helping the teachers to learn and implement the curriculum.

“Last year was our initial training year. You can’t expect teachers to do things out of the box, and this is especially complex,” Farran says. “This year is our first full implementation year. We have facilitators meeting regularly with teachers.”

Farran acknowledges that providing such facilitators in regular circumstances “would require genuine commitment by school districts. You need to be committed to helping teachers transition to this way of teaching. I think that’s true of almost any good curriculum.”

In the study’s third year, researchers will evaluate the sustainability of the curriculum in the classroom when the teachers no longer have assistance from facilitators. Researchers also plan on measuring the math progress of the study’s more than 700 children during their kindergarten year, which will not include the Building Blocks curriculum. The study’s final year will concentrate on data analysis.

Carol Bilbrey, Ph.D.’03, the research coordinator for the project, has received encouraging feedback from several participating pre-K teachers.

“The thing I really like—and what the teachers tell me—is that it reaches into what the child can understand in the world and can think about in a mathematical way,” Bilbrey says. “It’s about understanding math concepts, looking for defining features and quantity, comparing quantities and finding relationships among things. It’s a pretty new approach to teaching math, and the professional development component is strong. I’ve had teachers tell me, ‘I can’t believe the children can think this way.’”



An “a-ha!” moment in Riley’s pre-K classroom.

Hockey, Hats and ECE Math

At Peabody College’s Susan Gray School, teachers are encouraged to incorporate math into all aspects of their children’s daily activities.

“I want our teachers to be conscious of bringing more math into the curriculum,” says Ruth Wolery, the school’s director. “It’s part of everyday life. It can be embedded not only in school, but in everything kids do. Shopping, weights, measures, temperatures—it’s everywhere.”

Susan Gray School uses a literacy-based curriculum that allows teachers much flexibility in how they introduce math concepts to their preschool classrooms. They use the Curriculum Focal Points developed by the National Council of Teachers of Mathematics as a guide.

“We have a specific math time in the week, but I embed math concepts in other activities, such as art and dramatic play,” says Kyle Almgren, who teaches four-year-olds. “The best way for them to learn is to have multiple opportunities to learn.”

As an example of how she applies her literacy-based curriculum to teaching math, she points to recent lessons on winter sports.

“I’m a big hockey fan,” Almgren says. “One book we read was all about hockey. We talked about the numbers on the uniforms, how many games they had to win, and other ways math is related to the sport.”

Early childhood special education is a central to the Susan Gray School’s mission, which means teachers like Almgren have children with many different needs and abilities, including their typically developing peers, together in the classrooms. Flexibility is critical.

“You really have to build from where the children are,” Almgren says. “For children who aren’t at age level, you need to find things that are relevant to them.”

Wolery lauds Almgren’s creative skill in incorporating math into her classroom activities.

“She’s made graphs of the children’s favorite cookies,” Wolery says. “When they read *Caps for Sale*, Kyle put together a hat store. They had a store with money, a cash register. They even had credit cards.”

—Lisa Robbins

