Supports for Preschool STEM Learners and the Teachers Who Teach Them

Background

School-readiness gaps exist in language, literacy, mathematics, and science between at-risk and more-advantaged learners. Risk factors for lack of school readiness include being a non-Asian child of color, coming from a family of low socio-economic status, and speaking a home language other than English. Because the children who arrive in our preschools and elementary schools increasingly fit into one or more of these categories, innovative solutions to enhancing school readiness are critical.

Science has been identified as meaningful content for older English language learning (ELL) students, and high-quality math and science learning opportunities enhance learning in math, science, and language for preschoolers. Therefore, the SciMath-DLL project hypothesized that preschool STEM experiences would improve school readiness and English language and literacy skills for PreK dual language learners (DLLs). Unfortunately, the early education workforce is not well prepared to support STEM learning or DLLs. Teachers report discomfort teaching math and science, and observational studies show that little teaching occurs. Improved teaching practice is required before we can study effects of rich STEM learning opportunities on child outcomes.

The SciMath-DLL Approach to Professional Development

The SciMath-DLL project aims to provide inservice teachers with the classroom-based supports they need to improve practice. It involves the design, development, and preliminary testing of an inservice professional development approach that integrates high-quality math and science instructional offerings with supports for DLLs. Our project aims to enhance teacher knowledge and classroom interactions around mathematics and science, improve classroom supports for DLLs, and illustrate that rich math and science learning experiences contribute to improved classroom quality.

Collaborating educators from three urban school districts in New Jersey (Elizabeth, Long Branch, and Union City) worked with researchers to develop the content, procedures, and supporting materials for SciMath-DLL workshops, model lesson plans, teacher workgroups, and individualized practice-based coaching. Coaching follows a reflective cycle of planning, implementing, reflecting on practice, and goal setting for the next implementation cycle. Educator input and feedback has been critical to the success of the project and to creating professional development that is effective and practical to implement.

For example, based on teacher feedback, the content and structure of SciMath-DLL workshops has changed dramatically. PowerPoint slides and lectures have been replaced by multiple in-depth learning experiences that provide teachers with opportunities to participate in a model lesson, reflect on its implementation in the classroom, debate the value of various instructional decisions made when creating the lesson, and determine ways to differentiate the lesson for learners with different needs. Teachers leave workshops with many "things that they can do on Monday" as well as a deeper knowledge of the math and science content and pedagogical content knowledge required to teach these lessons well: *"The workshop helped me dramatically with understanding sink and float. I learned many activities to do in my classroom."*

Documented Results
During the first years of implementation, teachers and master teachers were asked to identify major implementation challenges. They noted the novelty of the coaching cycle, paperwork, and time limitations. Various solutions to these issues were developed for subsequent implementation years.

Educators noted that, even with challenges, the SciMath-DLL approach was valuable because it sanctioned and "forced" reflection on practice, which they value. After engaging in the approach, teachers and coaches noted (1) improved attitudes towards math and science teaching, (2) increased appreciation for reflection, (3) increased awareness that lessons are often "overstuffed," and (4) less directive, didactic teaching. Coaches reported learning STEM content and effective teaching methods, as well as gaining a better understanding of the reflective coaching cycle.

"It's amazing how much I learn just talking about what just happened, and not focusing on what went wrong, but just what worked, and what could be tweaked for next time. I think that it's so important."

"I truly value the way the program has challenged my perspective on teaching science. It's refreshing to have solid examples about the way science is around us. This allows our students to become permanent observers of the world around them."

"With [this project], the process has been very clear, and how to truly do the reflective cycle. So, that really enlightened me on how to work with a teacher."

Potential Applications
The SciMath-DLL approach works to change and improve teacher practice in district-based classrooms with master teachers as support. The workshop experiences that we have developed can be offered to educators in other settings, even those that do not have teacher coaches. One of the project's collaborating master teachers has used the reflective coaching cycle with community-based preschool providers to improve their practice for early math and science. The model could also be applied in early elementary school.

For More Information
Contact kbrenneman@nieer.org

Brenneman, K. (in press). Promising approaches to early childhood mathematics education (ECME) professional development through in-service training. In H.P. Ginsburg, M. Hyson, & T. Woods (Eds.), *Helping early childhood educators to teach math.* Baltimore, MD: Brookes Publishing.