i.e. information for educators

Preschool Math Programs: Creative Pathways to Knowledge

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> **"Mathematics is a more powerful instrument of knowledge than any other that has been bequeathed to us by human agency."**
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> *– Descartes*

All children have the potential to learn mathematics at a very young age. In fact, math helps them make more sense of their physical and social worlds. Young children invent mathematical ideas and strategies. For example, teachers and parents often hear, "I'm too big to wear that shirt" or "Mommy reads to me, then Dad, then Mom, then Dad ... That's a pattern!"

They even invent ways to solve simple addition problems, such as concluding that if they have three toys and get one more, they'll have four. Given what we know today, young children can make remarkable strides in math if they have opportunities to do so. Preschool teachers can make all the difference in the world if they "talk math" with their students.

Offer Opportunities

Readiness is less about being old enough (physically or mentally) and more about having opportunities to explore and think about the world mathematically.

- Help children learn to recognize small numbers. Talk with them not just about chairs around a table, but about four chairs around the table. By ages 4 and 5, children quickly recognize numbers up to five or six.
- Make counting meaningful. Have children count what's important to them, such as how many blocks they can stack before they fall, or how many leaves they've collected.
- Help children compare numbers. Do this visually at first, for example, by comparing a pile of 20 objects to another pile of 10. Later, use matching: "Are there enough paint brushes for the jars of paint?"
- Engage children in concrete problem-solving. For instance, show 3-year-olds a few blocks, cover them, and then put one more under the cover. Ask children to show them with their own blocks how many are under the cover.
- Take advantage of children's ability to share by working through math problems. For example, they can deal out crayons so that each of four children has exactly the same number.

Introduce Geometry

Young children also are ready to learn about simple geometry. They can match shapes, even when the shapes are turned in different directions. Just matching two identical sets of shapes is interesting to them. Children also can begin to learn to put shapes together to make pictures and new shapes.

Make Comparisons

Sometimes introducing math concepts is simply a matter of taking advantage of what children do naturally. For instance, they love to make comparisons, so ask them to compare objects directly by identifying which one is longer or takes up more space (area). Whenever children want to compare, make it mathematical by talking about the specific attribute, such as longer, wider, or heavier. Also compare numbers of things, such as the number of marbles in one bag compared to the number in another bag.

Structure the Environment

Educators can structure the classroom environment so the potential for mathematics surrounds children. Show them math in their everyday activities and plan special ones that focus on math. Support their curiosity and offer appropriate challenges such as:

- Provide lots of unit blocks, along with time to use them
- Ask a child to get just enough scissors for everyone in her group
- Challenge children to guess and check how many steps it is to the playground
- Sit down with children in large and small groups to pose, solve, and discuss mathematical problems.

It's important that teachers recognize moments for building mathematical language and concepts. For example, when two children each claim his building is the largest, a teacher can discuss how one is taller but the other is wider. Or, if you see children comparing the length of two rugs, make sure that connecting cubes, string, and other objects are close by for similar measuring.

Why Do We Need Mathematics Education in Preschool?

Much of our world can be better understood with mathematics, and children might as well start understanding their worlds when they are very young. Preschool mathematics invites children to experience math as they play in, describe, and think about their individual worlds and is necessary for four reasons.

1. Some preschoolers experience curricula that include only a small amount of mathematics — and usually that content is anemic. We should improve this situation.

2. Many of these children, especially those from minority and low-income groups, later experience considerable difficulty in school mathematics. Recent curriculum development projects have shown that the gap between these and other children can be narrowed. We must address these equity issues.

3. Preschoolers possess informal mathematical abilities and enjoy using them. Before they enter school, many children develop number and geometry abilities ranging from counting objects accurately to making shapes. Children use mathematical ideas in everyday life and develop informal mathematical knowledge that is surprisingly complex and sophisticated. Neglecting to nurture such interests would be an educational shame.

4. Although research on the brain has less to tell us about education than some suppose, it offers three general messages: preschoolers' brains undergo significant development; their experiences and learning affect the structure and organization of their brains; and their brains grow most as the result of complex activities, not from simple skill learning.

Consider Becca, who just turned 5 and whose sister, Karen, is 3 years old. Becca wandered into the room and made an announcement:

Becca: When Karen is 6, I'll be 8. When Karen is 9, I'll be 11. When Karen is 12, I'll be 14 … (she continues until Karen is 18 and she is 20).

Mom: My goodness. How on earth did you figure that out?

Becca: It's easy. You just go "three-FOUR-five" (clapping on the four). You go "six-SEVEN-eight." You go "nine-TEN-eleven."

Becca put together two aspects of her experiences: counting and songs that she sang rhythmically while jumping rope. This approach made sense to her, far more so than if an adult had tried to teach her an "add two" algorithm.

Why Real Math?

The mathematics research community has identified five strands of mathematical proficiency:

1. **Understanding** – Comprehending mathematical concepts, operations, and relations; knowing what math symbols, diagrams, and procedures mean

2. **Computing** – Carrying out mathematical procedures, such as adding, subtracting, multiplying, and dividing numbers flexibly, accurately, efficiently, and appropriately

3. **Applying** – Being able to formulate problems mathematically and devise strategies for solving them using concepts and procedures appropriately

4. **Reasoning** – Using logic to explain and justify a solution to a problem or to extend from something known to something not yet known

5. **Engaging** – Seeing mathematics as sensible, useful, and doable

SRA/McGraw-Hill's *Real Math* is the first mathematics curriculum to incorporate these five strands into each lesson, helping students gain both computation and problem-solving skills. *Real Math* balances skills-driven strategies and real-world practice to engage students in Grades Pre-K–6. It is taught with a unique instructional philosophy that doesn't just require calculation and memorization. Instead, it helps children understand math and internalize math concepts.

As the first and only full integration of mathematics and technology instruction, *Real Math* gives educators the tools to deliver motivating and rich math instruction.

Differentiated Instruction

Now more than ever, educators are focused on meeting mandated goals like Adequate Yearly Progress (AYP) and to improve student scores on standardized tests. *Real Math* provides differentiated instruction to meet the needs of all students: students requiring intervention; English-language learners; and high-achieving students ready for enrichment. The curriculum also includes a wealth of teacher support to help them face the diverse challenges in their classrooms. Resources include:

- Easy-to-use lesson plans
- Activity ideas
- Teaching tips
- Re-teaching strategies
- Assessment opportunities
- Practice sessions
- Professional development tools

Building Blocks

Building Blocks™ began as a National Science Foundation-funded project designed to enable all young children to build a solid foundation for mathematics. Now *Building Blocks* is the full curriculum for the Pre-K version of *Real Math*. *Building Blocks Software* also can be found in *Real Math* for Grades Pre-K–6. It constitutes the research-based multimedia activities that help children learn math through everyday activities.

Building Blocks emphasizes the National Council of Teachers of Mathematics' vision of mathematics for young children that:

- Builds upon their experiences with mathematics
- Establishes a solid foundation for the further study of mathematics
- Incorporates assessment as an integral part of learning
- Develops a strong conceptual framework that provides anchoring for skill acquisition.
- Involves children in "doing mathematics."
- Emphasizes the development of children's mathematical thinking and reasoning abilities
- Includes a broad range of content
- Makes appropriate and ongoing use of technology, including calculators and computers

These educational principles also are consistent with recommendations from the National Association for the Education of Young Children. The need for appropriate, challenging, and effective preschool and Kindergarten mathematics programs is especially salient for low-income children at risk for later school failure.

How Building Blocks Software Works

Building Blocks Software has activities for every step in each learning trajectory for different core mathematical topics. In other words, it helps children navigate an optimal learning path for each particular topic, such as shape composition. It provides:

- More than 190 engaging learning activities
- Built-in remedial help as soon as students begin to struggle
- Math buddies and electronic manipulative that make learning fun
- The ability to track each student's progress on each trajectory

Real Math Works!

All young children possess an informal knowledge of mathematics. It's important educators build upon and extend children's daily activities, interests, and questions, bringing math into the foreground. This approach ensures that mathematical content will be meaningful for young children.

For more information about *Real Math,* please call 1-888-SRA-4543 or visit SRAonline.com.

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