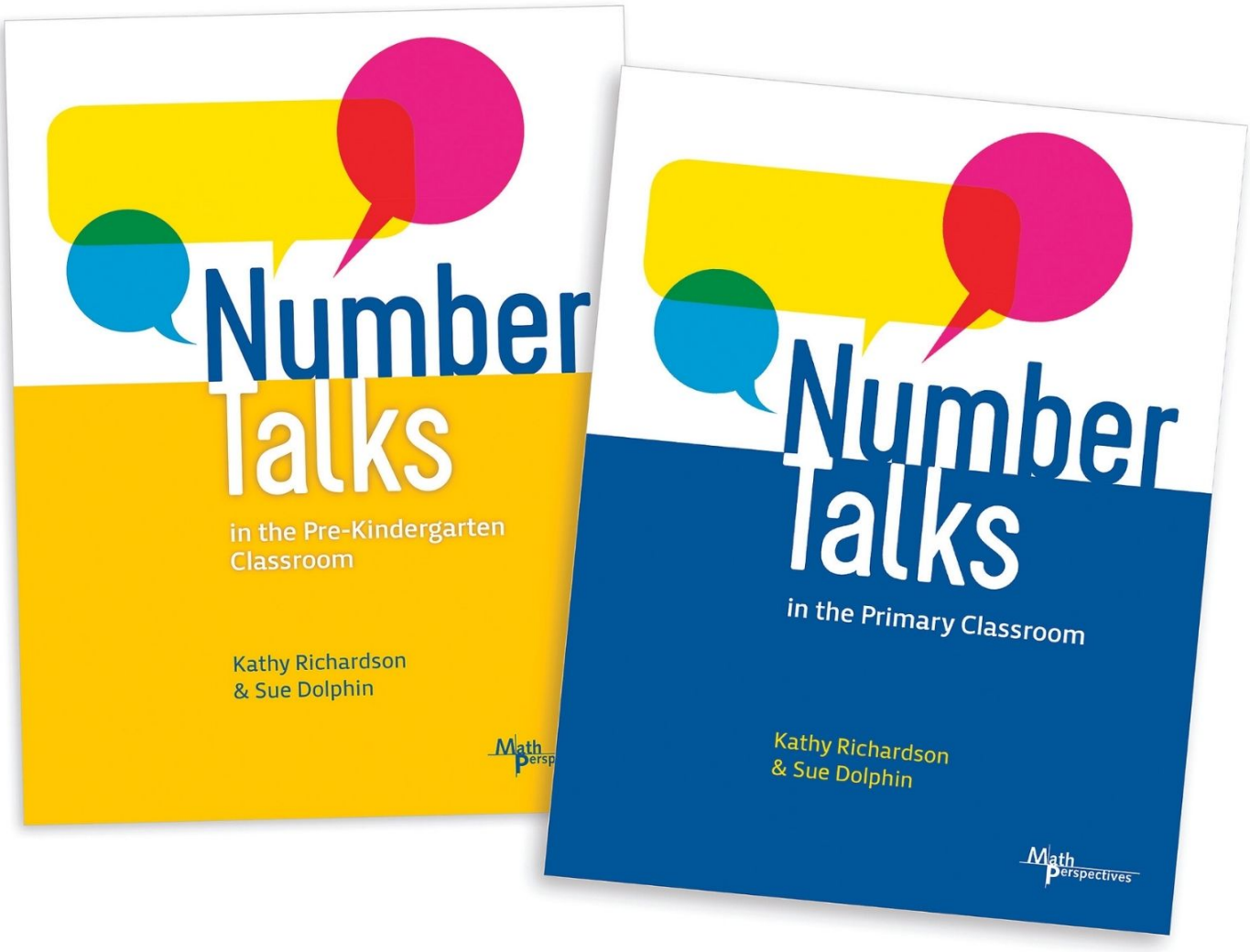
The Research Basis for the

Number Talks

Series



The Research Basis for Number Talks

Computational fluency refers to having efficient and accurate methods for computing. Students exhibit computational fluency when they demonstrate flexibility in the computational methods they choose, understand and can explain these methods, and produce accurate answers efficiently. The computational methods that a student uses should be based on mathematical ideas that the student understands well, including the structure of the base-ten number system, properties of addition and subtraction and multiplication and division, and number relationships.

Principles and Standards for School Mathematics p. 152

Description of Number Talks

Number Talks are an approach to developing facility with computation that engages children in thinking about numbers, and allows them to add, subtract, multiply, and divide using the mathematics that is meaningful to them, rather than using procedures that are not.

Research Basis

Understanding and Computational Fluency

... there is some evidence that understanding is the basis for developing procedural fluency. (Seigler)

Adding It Up, p. 197

Learning to use algorithms for computation with multi-digit numbers is an important part of developing mathematical proficiency. Algorithms are procedures that can be executed in the same way to solve a variety of problem arising from different situations and involving different numbers. Children can and do devise algorithms for carrying out
multi-digit arithmetic, using reasoning to justify their inventions and developing confidence in the process. (Carpenter, Franke, et al)

Adding It Up, p 7

When the initial computational procedures that students use to solve multi-digit problems reflect their understanding of numbers, understanding and fluency develop together.

Adding It Up, p. 196

... instructional programs that emphasize understanding algorithms before using them have been shown to lead to increases in both conceptual and procedural knowledge. (Fuson, Wearne, et al)

Adding It Up, p. 196

Invented procedures for computation enhance both number sense and accuracy. (Carroll and Porter)

Putting Research Into Practice p. 16

"Students gain confidence in their ability to do mathematics when they use strategies that they understand." (Chambers)

Putting Research Into Practice pp. 14

The Mathematics: The Structure of Numbers

"More than just a means to produce answers, computation is increasingly seen as a window to the deep structure of the number system."

Adding It Up, p. 182

The procedures children construct on their own build directly on the foundational number concepts, and these underlying concepts often are quite visible when one examines the steps in the procedures.

Adding It Up, p. 152

"For students in grades K to 2, learning to see the part-whole relations in addition and subtraction situations is one of their most important accomplishments in arithmetic."

"Experiences that focus on part-part-whole relations have also been shown to help students develop more efficient thinking strategies, especially for subtraction. (Armstrong)

Adding It Up, p. 191

Adding tens first seems simpler and is more meaningful for many children who regroup mentally with fluency. (Carroll and Porter)

Putting Research to Practice p. 17

Lack of Understanding Leads to Errors

"When students fail to grasp the concepts that underlie procedures or cannot connect the concepts to the procedures, they frequently generate flawed procedures that result in systematic patterns of errors. (Seigler)

Adding It Up, p. 196

"Efficiency without understanding leads to errors, and errors lead to lack of confidence." (Chambers)

Putting Research Into Practice p.14

Discourse/ Explaining Their Thinking

Students who spent more time on fewer problems and were asked to explain their procedures outperformed their more traditionally taught peers. (Heibert, J. and Wearne, D.)

Adding It Up, p. 191

The focus of instruction should be on their understanding and explaining and not just on routine use.

Adding It Up, p. 213

Encouraging dialogue and conceptual splatter (i.e diversity of ideas and concepts held by students) can lead to a more solid mathematical foundation for students. Children's ideas must be viewed as genuine intellectual proposals deserving every consideration." (Easley, et al)

Putting Research to Practice p. 53

The airing of ideas leads to self-correction.

Putting Research to Practice p. 53

Use of Models

Mathematics achievement is increased through the long-term use of concrete instructional materials. (Sowell, 1989)

Students learn well from a variety of instructional approaches, including those that use physical materials to represent hundreds, tens, and ones... (Heibert, Carpenter, Fennema, Fusan Warne, Murray, Oliver and Human, 1997)

Number Talks Research Application

Number Talks incorporates all of the ideas and strategies found in the research outlined in this document. Number Talks provide opportunities for students to work with computation in meaningful ways. During Number Talks, the teacher presents various problems to groups of children and asks them to share the processes they used. Number Talks can be held either with the whole class or with small groups. When students are working with the whole class, they will have opportunities to experience a wide range of problems and many different ways to solve them. When working with a small group, the teacher can make sure all the children have the opportunity to share their processes if
they wish and can more easily tailor the problems to meet the needs of a particular group.

Number Talks are structured as short sessions alongside (but not necessarily related to) the ongoing math curriculum. The goal is to keep Number Talks short, as they are not intended to replace current curriculum or take up the majority of the time spend on mathematics. In fact, teachers need to spend only 5 to 15 minutes on Number Talks. Number Talks are most effective when done every day. Frequent and consistent practice will yield results.

Number Talks include:
• A variety of problems at various levels of difficulty
• A safe environment
• Concrete models
• Opportunities to think about it first
• Interaction
• Self-correction

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395 Main Street
Rowley, MA 01969
www.didax.com

P.O. Box 29418
Bellingham, WA 98228
www.mathperspecitves.com