



Leading innovative efforts
to engage communities in
mathematics teaching and learning

Implementing Research-Informed
Evidence-Based
Mathematics
TEACHING



Placing
research-
informed,
evidence-
based practices
in the hands
of educators
and the
communities
they serve

Inside this brochure, you'll find a wealth of research-backed insights and valuable resources dedicated to promoting rich math tasks and fact fluency.

International assessment data shows that students who develop a deep understanding of mathematics outperform their peers who rely on memorization and rote procedures.¹ To think deeply about mathematics concepts, students must have the opportunity to work on interesting and novel problems that emphasize authentic application.² Processes for solving rich problems are central to nationally respected standards^{3,4} and frameworks,² and ensure students have the experiences necessary to learn and do mathematics.⁵

The information illuminated on each page draws on recommendations by leading organizations, such as the National Council of Teachers of Mathematics (NCTM), that not only promote high expectations and excellence for all students but also define the mathematics content and thinking skills students need to pursue a full range of college and career opportunities.

What is a rich math task?

“A rich task or problem can be presented in words or expressed using only numbers. It can be a game or a puzzle. It is a task to which there is no immediate known solution-path on the part of the learner. A rich task presents a high level of cognitive demand and requires students to think abstractly in order to make connections to and among mathematical concepts. As students work to reach a solution, new mathematics concepts unfold, and deeper understanding occurs.”⁶ (p. 3)

How long does it take to implement?

Depending on the task identified, rich task implementation could take ten minutes, one instructional block, or multiple days.

What does the research say about implementing rich math tasks?

Student achievement increases when students investigate math ideas in context, use various computational strategies, and collaborate around dynamic and interesting tasks.⁷

Rigorous math learning experiences, such as implementing rich math tasks, contain content that challenges students and **promotes strategic and flexible thinking**.⁸

Regular opportunities to build deep understanding through tasks with high cognitive demand **increases student math performance**.⁹

The ability to complete rich math tasks **supports transfer of math concepts and skills** to new contexts and problems.²

What is math fact fluency?

“Knowing basic number combinations - the single digit addition and multiplication pairs and their counterparts for subtraction and division - is essential. Equally essential is computational fluency - having and using efficient and accurate methods for computing... Regardless of the particular method used, students should be able to explain their method, understand that many methods exist, and see the usefulness of methods that are efficient, accurate, and general.”¹⁰ (p. 32)

How do students develop fact fluency?

While mastery and automaticity are outcomes of practice, fluency with math facts moves beyond memorization and attends to efficiency, flexibility, and accuracy.^{11,12} Understanding the role and meaning of arithmetic operations in number systems is key to developing fact fluency.^{13,14}

What does the research say about developing fact fluency?

Student learning is greatest in classrooms where math facts are taught using number relationships and reasoning strategies.¹⁵

Using number relationships, benchmarks, and reasoning strategies **supports students' emerging conceptual understanding and flexibility**.¹⁶

Timed tests do not allow teachers to assess fluency as they do not attend to efficiency, flexibility and the individual needs of the learner.^{17,18}



Resources for Implementing Rich Math Tasks

BOOKS

- *Taking Action: Implementing Effective Mathematics Teaching Practices Series* (K-5, 6-8, 9-12), NCTM
- *5 Practices for Orchestrating Productive Mathematics Discussions* (2nd Edition), Smith & Stein
- *The 5 Practices in Practice Series* (Elementary, Middle School, High School), Smith, Sherin, & colleagues
- *Classroom-Ready Rich Math Tasks: Engaging Students in Doing Math Series* (K-1, 2-3, 4-5), Kobbett & colleagues
- *Classroom-Ready Rich Algebra Tasks: Engaging Students in Doing Math*, Dougherty & Venenciano

WEBSITES

[Bridging for Math Strength](#)

[3-Act Tasks](#)

[Illustrative Mathematics](#)

[NRICH Mathematics Resources for Teachers, Parents and Students](#)

[Virginia Department of Education: Rich Mathematical Tasks](#)

Resources for Building Fact Fluency

BOOKS

- *The Figuring Out Fluency in Mathematics Teaching and Learning Series*, Bay-Williams, SanGiovanni, & colleagues
 - Moving Beyond Basic Facts and Memorization, Grades K-8
 - Classroom Companions: Addition & Subtraction with Whole Numbers; Multiplication & Division with Whole Numbers; Operations with Rational Numbers and Algebraic Equations; Addition & Subtraction with Fractions and Decimals; Multiplication & Division with Fractions and Decimals
- *Math Fact Fluency: 60+ Games and Assessment Tools to Support Learning and Retention*, Bay-Williams & Gina Kling
- *Number Talks: Whole Number Computation*, Parrish
- *Number Talks: Fractions, Decimals, and Percentages*, Parrish & Dominick
- *Building Powerful Numeracy for Middle and High School Students*, Harris
- *Lessons and Activities for Building Powerful Numeracy*, Harris

INSTRUCTIONAL TOOLKIT

[Building Fact Fluency, Fletcher & Zager](#)

WEBSITES

[Math Fact Fluency Companion Website](#)

[Procedural Fluency in Mathematics: A Position of the National Council of Teachers of Mathematics](#)