

Mathematical Fluency: A Practical Primer

SOLVE these two subtraction problems:

- $201 - 195 =$
- $201 - 68 =$

NOW REFLECT: How did you solve each problem?

Did you use the same strategy for both? Why or why not?

How you approach those problems—your calculations, accuracy, and reflection—reveals your level of mathematical fluency. In this case, fluency is the difference between seeing subtraction as simply “taking away” or “counting down,” and understanding it as “finding the difference” between two numbers.

This primer offers an overview of mathematical fluency, and a sneak peek into a forthcoming report on the topic that illuminates how some of America’s largest school districts are zeroing in on fluency as a key lever for improving math learning and achievement.

“Fluency is not just about knowing your algorithms—it’s about flexibility, efficiency, and accuracy. As a nation, we hyperfocus on accuracy at the expense of efficiency and flexibility.”

— Dr. Jennifer Bay-Williams

Author of *Figuring Out Fluency in Mathematics Teaching and Learning*

WHAT IS MATHEMATICAL FLUENCY?

Fluency in Context

In 2001 the **National Academies** published *Adding It Up*, a report on K–8 mathematics that called out the 20th Century’s over-emphasis on reinforcing computational procedures in math teaching and learning. The Academies advocated for a redefined view of mathematical proficiency, emphasizing five interconnected and mutually reinforcing strands:

- Conceptual Understanding
- Procedural Fluency
- Strategic Competence
- Adaptive Reasoning
- Productive Disposition

The report emphasized that true proficiency—the ability to productively and appropriately apply mathematical skills and reasoning in real-world contexts—depends on learners understanding the interconnected nature of these strands and applying their knowledge to solve problems effectively. The **National Mathematics Advisory Panel’s 2008 report, *Foundations for Success***, reinforced the findings of *Adding It Up*, stating: “For all content areas, conceptual understanding, computational fluency, and problem-solving skills are each essential and mutually reinforcing, influencing performance on such varied tasks as estimation, word problems, and computation.”

Flexibility, Efficiency, Accuracy

Adding It Up describes procedural fluency as “knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.” These three interconnected pillars—flexibility, efficiency, and accuracy—reflect how a student navigates a problem; not just whether a student arrives at the correct response, but how thoughtfully and strategically the student approaches the problem.

Of the five strands of mathematical proficiency, procedural fluency is perhaps the most commonly misunderstood. Quick answers and rote recall are often mistaken for fluency, but true fluency requires deeper, more flexible thinking.

In her book, *Figuring Out Fluency in Mathematics Teaching and Learning*, renowned mathematics educator Dr. Jennifer Bay-Williams shines a light on this common confusion and oversimplification: “Fluency has long been interpreted as adeptly implementing algorithms, yet real fluency is a creative process in which a person is able to choose a strategy that makes sense for the numbers at hand. Real fluency, therefore, requires conceptual understanding of the operations, understanding properties, and having a repertoire of methods.”



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Fluency ≠ Automaticity

Automaticity refers to recalling facts quickly, such as knowing that $6 \times 7 = 42$ without hesitation. Fluency, however, goes beyond speed to include understanding, reasoning, and adaptability. While automaticity is an important outcome for learning basic facts, having basic fact fluency enables a student to not only recall 42 but also generate the answer through a strategy. For example, knowing $3 \times 7 = 21$ and doubling the answer or knowing 5×7 is 35 and adding one more group of 7 to get 42. These strategies are useful when an answer is forgotten or when a student seeks to confirm they are correct.

Students who excel at memorization and rote procedures may see early success in mathematics; however, rote learning of facts and algorithms is limiting as mathematics becomes more about the repeated application of conceptual understandings. For instance, **fluency with whole numbers, fractions, and computational strategies lays the groundwork for success in Algebra I—a strong predictor of academic and economic achievement.**

Without the deeper understanding, reasoning, and adaptability that define true fluency, students may be fast, but not nimble. They can recall facts quickly, yet struggle to shift strategies, make connections, or adjust when problems become more complex. Fluency is less about speed and more about the ability to move confidently in any direction at any point in the problem-solving process.

“Fluency with basic facts is not just having the facts in your memory but having strategies for using them,” says Dr. Bay-Williams. “It’s the difference between repeating a memorized procedure and understanding why a method works and when to use it.”

A Call for Shifts in Math Education

Mathematical fluency comprises more than just speed and automaticity—it involves flexibility, efficiency, and accuracy. Together, those pillars reflect a deep understanding of mathematical concepts. Fluency is not solely about getting the correct answer—it’s about the ability to select sensible strategies for a given problem and adjusting when needed.

Ultimately, fluency is about creativity and decision-making, and students can demonstrate fluency by choosing and adapting their own strategies—not just following prescribed steps.

To unlock that potential in every student, K–12 math education must shift away from rote procedures and narrow definitions of success, and instead focus on providing opportunities to explore, make sense of numbers, and develop flexible strategies through meaningful, engaging tasks.

**“Everyone is a math person.
Every learner can thrive and be
fluent in math when given
opportunities to access high-
quality instruction and meaningful
learning opportunities.”**

— Dr. Afi Wiggins
Managing Director, The Dana Center

The National Math Improvement Project (NMIP) is a community of practice that includes the academic leadership and math teams from six of the largest high-poverty districts coming together over three years to develop and enact policies and strategies to improve student outcomes in math. NMIP’s six districts collectively serve over 2.5 million students from a variety of socioeconomic backgrounds. While each district faces its own unique, local context, they share challenges rooted in the sheer size and scale of their agencies, as well as the diverse student populations served. NMIP is working to address the following core challenges and improve math education for students nationwide.

