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Fluency in mathematics is often misrepresented. Here, you can explore the first two of 12 Fluency Fallacies and what truths they unveil about mathematical fluency.

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CHAPTER 2

Fluency Fallacies and Related Truths

In Chapter 1, fluency—specifically, procedural fluency—was defined through Fluency Actions and the presence of reasonableness. These observable actions are necessary for focusing on what must be explicitly taught and assessed. Yet, beyond these observables are a host of long-standing beliefs and practices about procedural fluency, and many of these unproductive beliefs and related practices create inequities in the learning of mathematics. To blame are a lack of precise language, limited conceptions of algorithms, and misaligned expectations for learning and teaching fluency. In fact, the prevalence of these issues has a considerable effect on what does and doesn't happen in mathematics programs and classrooms. We dub these the “Fluency Fallacies,” and we present a dozen of them across four categories, countering each fallacy with a truth that reflects research and best practice in teaching for procedural fluency.



In this chapter, you will

- Explore 12 prevalent Fluency Fallacies
- Identify ways to address the fallacies
- Examine “truths” that help clarify a real focus on fluency

LANGUAGE FALLACIES

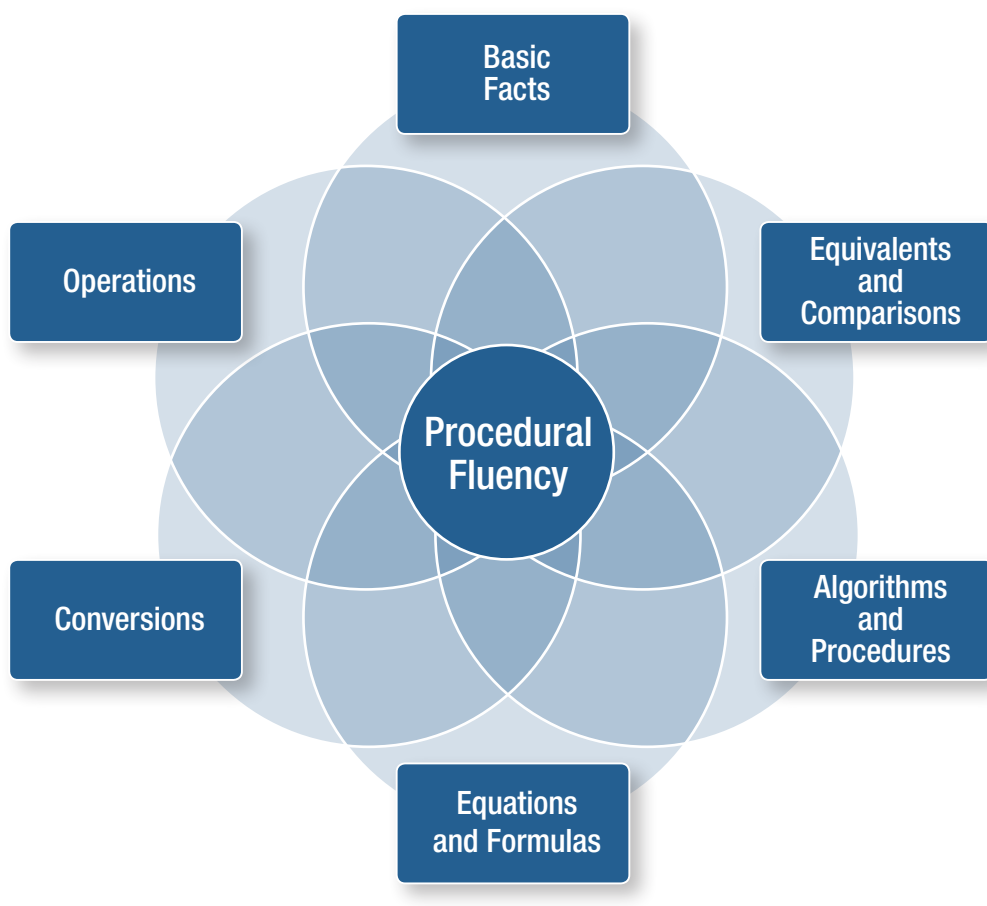
Have you heard a teacher, student, or presenter say she or he is working on fluency and wonder exactly what that meant? Or have you been on Amazon or at the bookstore and looked inside of a “fluency” book to find it wasn't what you were looking for? As a field, we have been sloppy about the use of this term, and we must quit using it inappropriately. Here, we share three fallacies related to the language we use.

Figuring Out Fluency in Mathematics Teaching and Learning, Grades K–8: Moving Beyond Basic Facts and Memorization by Jennifer M. Bay-Williams and John J. SanGiovanni. Copyright © 2021 by Corwin Press, Inc. All rights reserved.

FLUENCY FALLACY #1: FLUENCY IS ABOUT BASIC FACTS.

There are several reasons why people might draw the conclusion that fluency is only about being facile with basic facts, meaning single-digit operations. Textbooks and websites have “fluency practice” that is focused on basic facts. Fact tests are often titled (albeit, inaccurately) as “fluency tests.” Articles about basic facts use the word “fluency,” and we hear “I am working on fluency” from someone teaching basic facts. The truth is that fluency *includes* basic facts, but it is a much, much bigger field. Fluency applies to virtually every procedure in mathematics, from operations with whole numbers through all rational numbers, finding equivalents, making conversions, solving equations, and so on. Fluency might be thought of as a confluence of the domains, as seen in Figure 2.1.

FIGURE 2.1 ● Content Domains of Procedural Fluency



This fallacy is particularly relevant when engaging with families. Many adults view learning basic facts as a seminal experience in their mathematics education, so this is what comes to mind when they hear the word “fluency.” Additionally, places where parents may seek “fluency” resources (bookstores and Amazon) have mostly basic facts re-

sources. Make no mistake, basic fact fluency is an important idea in mathematics education. It simply is not the only pursuit nor is it all that fluency is. We can help families and other stakeholders by placing clarifying words in front of fluency—for example, basic fact fluency (or math fact fluency) versus procedural fluency, operational fluency, or fluency with conversions between measurement units.

Truth: Fluency includes basic facts and *so much more*, including (but not limited to) multidigit operations, decimal and fraction operations, operations involving negative numbers, comparing fractions, solving proportions, and solving equations.

FLUENCY FALLACY #2: MASTERY, FLUENCY, AND AUTOMATICITY ARE THE SAME THING.

Ideas about mastery, automaticity, and fluency are tangled, and unfortunately, the terms are used interchangeably. Books around that are labeled “fluency practice” that are nothing of the sort; instead, they are practicing a standard algorithm. They feature rote practice with basic facts and standard algorithms. Sadly, it is not just books at the bookstore. Fluency searches on the web and on popular teacher resource websites return things that are *not* fluency but are either focused on automaticity with facts or mastery of algorithms.

Mastery is an outcome having to do with execution of a skill. For a skill such as an algorithm, this means that a student has “got it down.” In other words, students can carry out the process in a reasonable amount of time and get the right answer. They know the steps and execute them mostly flawlessly. The practice experiences found in bookstores and on websites are most often worksheets aimed at mastering a skill. They might be better named something like “algorithm practice” or “skill practice.” But *they should not be called fluency practice.*

Automaticity, like mastery, is an outcome, usually used to mean a student has “mastered” a basic fact. For example, $9 + 6$ is said to have been mastered when a student answers without hesitation—either because they just know the sum or are enacting a strategy with great facility. Automaticity means being able to efficiently produce answers from a memory network via automatic reasoning processes or fact recall (Baroody, 2016). For basic facts, the terms “mastery” and “automaticity” can be used interchangeably. There are other topics, beyond basic facts, that need to be, in time, automatic. These “automaticities” play a critical role in fluency and will be discussed in greater detail in Chapter 5.

Procedural fluency, as described in Chapter 1, is a comprehensive way of navigating mathematical procedures; it includes mastery of algorithms and strategies, but it also includes knowing when to use them. Because

fluency is a way of thinking and reasoning, it cannot be “mastered.” It grows, evolves, adapts, and changes. But it certainly can and must be practiced. True procedural fluency practice *must attend* to the three components of fluency (and more than two of the Fluency Actions). Try to find a “true” fluency worksheet online—they are few and far between. How might you recognize if a worksheet or other practice opportunity focuses on fluency? One big hint is that the directions for fluency practices *do not* tell the student *how to solve* each problem (e.g., “Solve using the standard algorithm”) or *how to think* (e.g., “Use base-10 blocks to show ...”). These directions signal skill practice and thus a focus on mastery. Sometimes, you can cross out these instructions and infuse a fluency focus by having students employ their own strategy (and tool) selection. However, many worksheets do not provide problems that lend themselves to different methods, and they aren’t helpful as a fluency experience.

Truth: Mastery and automaticity mean getting skills (and facts) down. They are outcomes of practice. Fluency includes mastery of skills and automaticities, but it also includes decision-making. Fluency practice attends to efficiency, flexibility, accuracy, and reasonableness. In mathematical terms,

Mastery \approx Automaticity

Fluency $>$ Mastery