

Procedural Fluency: More Than Memorizing Math Facts

By [David Ginsburg](#) on July 15, 2012 7:27 PM

Procedural fluency or conceptual understanding--math educators have debated for years which is more important. I sided with conceptual understanding until my colleague **Angela McIver** helped me see the value of procedural fluency in terms of stamina. Like all of us, students have finite energy. The more energy they use for procedures, the less energy they have for problem solving. And the less energy they have for problem solving, the less likely they are to gain conceptual understanding. A lack of procedural fluency can therefore contribute to a lack of conceptual understanding.

The issue, then, isn't *if* we should target procedural fluency but rather *how* we should target it. And, how to do so while also targeting conceptual understanding, as called for by the **Common Core State Standards** (the "dual intensity" instructional shift I mentioned in my **last post**).

Of course, it's hard to help students achieve something if you don't know what it is. A lot of teachers think procedural fluency is synonymous with "knowing your math facts," but it's more than that, as defined in the **National Research Council** book, *Adding It Up: Helping Children Learn Mathematics*:

Procedural fluency refers to knowledge of procedures, knowledge of when and how to use them appropriately, and skill in performing them flexibly, accurately, and efficiently.

Does procedural fluency involve memorizing multiplication tables and other facts? Sure, but it also involves thinking. Students must know *when*, as opposed to just *how*, to use a procedure. And they must not only be able to perform procedures accurately, but also flexibly and efficiently--again, think stamina.

To illustrate the thinking aspect of procedural fluency, I ask teachers at workshops how their students would solve the following problem: $7/11 = ?/121$. Middle and high school teachers say most of their students would cross-multiply, which provides the correct solution of 77 ($7 \times 121 / 11$). Elementary teachers say most of their students would use the equivalent fractions approach, which also provides the correct solution ($121/11 = 11$; $11 \times 7 = 77$). Which approach is more efficient? Well, which is easier: multiplying 7×121 or 7×11 ?

One reason students don't always choose the most efficient method is that they don't really choose any method. They just apply an algorithm without thinking. They know how to use procedures but not always when to use them. They perform procedures accurately but not always flexibly or efficiently. In other words, they lack procedural fluency.

This brings us back to the Common Core challenge of helping students develop procedural fluency while also helping them develop conceptual understanding. And here are a few suggestions for meeting this challenge:

- Model for students (and/or allow them to discover on their own and from each other) multiple solution strategies (example: **comparing fractions**).
- Establish connections between new topics such as proportions (and cross-multiplying) and previous topics such as equivalent fractions.
- Build procedural understanding through conceptual understanding whenever possible (example: **adding and subtracting integers**).

Will these ideas ensure procedural fluency for students? No. They still need to know their facts in order to use procedures flexibly, accurately, and efficiently. In the above problem, for example, the equivalent fractions approach is only more efficient than cross-multiplying if students have memorized multiples of 11.

I'll address the facts-fluency connection further in a future post, since I don't have the stamina for it now. Check out Jo Boaler's recent Ed Week article, *Timed Tests and the Development of Math Anxiety*, in the meantime.

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