Fluency and Math Modeling

Fluency has many parts. The National Council of Teachers of Mathematics (NCTM) identifies) four components of fluency: (1) apply procedures accurately, efficiently, and flexibly; (2) transfer procedures to different problems and contexts; (3) build or modify procedures from other procedures; and, (4) recognize when one strategy or procedure is more appropriate to apply than another. (http://tinyurl.com/NCTM-Fluency)

Engage in math modeling regularly. Good modeling tasks address multiple standards. For instance, students completing the task *"What Does 2,000 Calories Look Like?"* might engage in five standards (6.EE.3, 6.EE.6, 6.RP.2, 7.EE.1, and 7.EE.4) simultaneously, which is more efficient, integrated and impactful than teaching one standard each day for five days. (http://tinyurl.com/2k-cals)

Select activities based on your goals. Determine class activities based on your instructional goals. Choose fun and engaging activities that apply and reinforce concepts. The following sites offer a number of modeling resources:

- Illustrative Mathematics: https://www.illustrativemathematics.org/
- Dan Meyer's 3-Act Tasks: http://blog.mrmeyer.com/category/3acts/

Share alternate strategies. For problems with computation, demonstrate multiple solutions. For instance, show how the equation $7/12 = x/84$ can be handled with cross-multiplying or equivalent fractions. Although cross-multiplying might be considered more advanced, it involves finding the product of 7×84. On the other hand, using equivalent ratios only requires calculating 7×7.

Nix the tricks. FOIL is limiting — it only teaches students how to multiply binomials. Instead, teach students to use the distributive property no matter how many terms are in each factor. Likewise, teaching students to "invert and multiply" when dividing fractions is not nearly as effective as having them use common denominators and discover shortcuts on their own. Tina Cardone and #MTBoS have put together "*Nix the Tricks*" (http://nixthetricks.com), a guide for developing conceptual understanding and procedural fluency at the same time.

Fluency develops over time. Procedural fluency follows a developmental progression, and the expectations for students at various ages and grades will differ. For instance, when playing a dice game, a kindergartener who rolls three 5's might count the dots, but a fluent third-grader would recognize three groups of 5 as $3 \times 5 = 15$. Likewise, a middle school student might use an area model for multiplying a monomial by a binomial, but a high school student should apply the distributive property using symbols.

There are often multiple algorithms for the same procedure. Common Core standards never provide a definition of *standard algorithm*, nor do they provide examples. Further, variations in an algorithm can often be used productively in a classroom. Fuson and Beckman (2013) discuss this topic at http://tinyurl.com/Fuson-Beckmann-Algorithms.

For more info, refer to the progressions document at http://tinyurl.com/CC-Modeling.