Understanding the Math!

BENEFITS OF ALTERNATIVE STRATEGIES

STUDENTS MAKE FEWER ERRORS-Research reveals that students using methods they understand make fewer errors than when they use a strategy they learned without understanding. (Gravemeijer & van Galen, 2003; Kamii & Dominick, 1998)

LESS RETEACHING IS REQUIRED- One might initially be concerned when if your child's early efforts with alternative strategies are slow and time consuming. However, the extended struggle in these early stages builds a meaningful and well-integrated network of ideas that is long lasting.

STUDENTS DEVELOP NUMBER SENSE-Your child's development and use of number-oriented flexible strategies offers him a rich comprehension of the number system. Students rarely use an alternative strategy they do not understand. In contrast, students using standard algorithms are often unable to explain why they work.

ALTERNATIVE STRATEGIES ARE THE BASIS FOR MENTAL MATH AND ESTIMATION-When alternative strategies are the norm for computation, there is little need to discuss mental computation or estimation as separate skills.

FLEXIBLE METHODS ARE SOMETIMES FASTER THAN STANDARD ALGORITHMS-Consider 761 + 467. A simple alternative strategy might involve 700 + 400 = 1100 and 60 + 60 = 120. The sum of 1100 and 120 is 1220 and add 8 more for 1228. This is done mentally, or even with some recording, in much less time than the steps of the standard algorithm.

ALGORITHM INVENTION IS ITSELF A SIGNIFICANTLY IMPORTANT PROCESS OF "DOING MATHEMATICS"-Students who select from a variety of strategies for computing, or who adopt a meaningful strategy shared by a classmate, are involved intimately in the process of reasoning and sense making. They also develop confidence in their ability to learn mathematics.

ALTERNATIVE ALGORITHMS SERVE STUDENTS WELL ON STANDARIZED TESTS-As an added bonus, students tend to do well with word problems because these problems are the principal vehicle for developing invented algorithms. Oftentimes students' abilities to estimate with invented strategies help them eliminate unreasonable multiple-choice items and move more rapidly through the test.

A Definition of a "Standard Algorithm"

An algorithm is any series of steps, which, if followed properly, always yield a correct result. There are many ways to add, subtract, multiply, and divide that meet this definition. ALL ALGORITHMS are based on place value.

CONTRASTS WITH STANDARD ALGORITHMS (traditional math)

1. INVENTED STRATEGIES ARE NUMBER ORIENTED RATHER THAN DIGIT ORIENTED. For example, one strategy for 68 X 7 begins with 60 X 7 is 420 and 56 more is 476.
2. INVENTED STRATEGIES ARE LEFT-HANDED RATHER THAN RIGHT HANDED. Invented strategies often begin with the largest parts of the numbers because they focus on the entire number.
3. INVENTED STRATEGIES ARE A RANGE OF FLEXIBLE OPTIONS, RATHER THAN "ONE RIGHT WAY." The standard algorithm suggests using the same tool on all problems. The standard algorithm for 7000-25 typically leads to student errors, yet a mental strategy is relatively simple.

The Standard Algorithm...WHEN?

The *Common Core State Standards* require that students eventually have knowledge of the standard algorithm. Computational work begins long before knowledge of the standard algorithm is required. This again points out the need for conceptual development to take place. The *Common Core Standards* recognize that starting by teaching only the standard algorithm doesn't allow for students to explore other useful approaches. Understanding how algorithms work and when they are the best choice is central to development of procedural proficiency.

By the end of 4th grade, the students will fluently add and subtract whole numbers using the standard algorithm.

By the end of 5th grade, the students fluently multiply multi-digit whole numbers using the standard algorithm.

By the end of 6th grade, the students fluently divide multi-digit numbers using the standard algorithm.

Adapted from Teaching Student-Centered Mathematics by John A. Van de Walle