Algorithms* or Models?
Problem Statement

Scenario 1

Many students in Joan's ABE math class have been working for a month on adding fractions and mixed numbers with like and unlike denominators. They have been practicing with several pages of computation out of a workbook, and seem to be getting better, even though many still use their times tables as an aid. With all this practice and opportunity to work on fractions, Joan doesn't understand why no one is able to easily solve the problem, "What is 5 ½ + 12 3/4 ?"

Scenario 2

In her ABE math class, Abby provides her students with plenty of practical and concrete opportunities to reason with common "benchmark" fractions such as halves, quarters, eighths, and tenths. They develop and share a variety of strategies. They can confidently solve problems like "What is 5 ½ + 12 3/4 ?" While most are very good at estimating answers to problems like "5 5/12 + 8 19/24" (a little more than 14), they have not spent much time learning the method taught in the workbooks, so they tend to reach for the calculator in that case.

Among math teachers at all levels, there has been much discussion about teaching for understanding vs. teaching algorithms. In adult education, we have an added dilemma because usually our students are with us for a short period of time. We have to make the most of their time while they are with us. So, do we show them the most "efficient" way to solve a problem, or do we try to ensure that they have an understanding of the concept, taking time to ask them to visualize or create models of critical concepts in math? When do we just teach the process (or algorithm)? When do we ask students to develop their own models for understanding?

Consider the questions on the next page with your regional or local group:

* An algorithm is a step-by-step procedure designed to achieve a certain objective in a finite time for efficiency's sake, often with several steps that repeat or "loop" as many times as necessary. The most familiar algorithms are the procedures for the four basic operations: adding, subtracting, multiplying, and dividing, but there are many other algorithms in mathematics.

Questions to Guide Discussions

Discuss these questions in local or regional groups

1. What advice would you give the teachers (Joan and Abby) in each of the scenarios?

2. When do *you* teach algorithms? When do *you* teach for understanding?

3. How do you reconcile the difference between wanting to teach for understanding and showing students the most efficient generalized method?

4. From your experience, how would you describe your students' ability to use math when they enter your classroom? When they leave your classroom after a period of instruction?

5. According to Brophy (Brophy, Jere. "Probing the Subtleties of Subject-Matter Teaching." EDUCATIONAL LEADERSHIP (April 1992): 4-8), *Current research, while building on findings indicating the vital role teachers play in stimulating student learning, also focuses on the role of the student. It recognizes that students do not merely passively receive or copy input from teachers, but instead actively mediate it by trying to make sense of it and to relate it to what they already know (or think they know) about the topic. Thus, students develop new knowledge through a process of active construction. In order to get beyond rote memorization to achieve true understanding, they need to develop and integrate a network of associations linking new input to preexisting knowledge and beliefs anchored in concrete experience. Thus, teaching involves inducing conceptual change in students, not infusing knowledge into a vacuum* (p.5). Do you agree or disagree with his comments? Why? How might your beliefs influence your teaching?

Suggested advance readings

"Teaching for Understanding: Educating Students for Performance" http://www.weac.org/resource/june96/under.htm for a review on beliefs about learning and about teaching

"Concept vs. Computation: The Teacher's Role" http://www.math.uic.edu/~jbaldwin/pub/mamer.html reviews some of the findings from Dr. Ma's significant study on how American teachers teach basic operations.