Developmental Stages of Computational Fluency

Direct Modeling

Student-invented strategies
Why is this important?
- They are number oriented rather than digit oriented.
- They are often left-handed rather than right-handed.
- Invented strategies are flexible rather than "one right way."

Benefits
- Students make fewer errors
- Less reteaching is required
- Students develop number sense
- Invented strategies are the basis for mental computation and estimation.
- Flexible methods are often faster than the traditional algorithms
- Algorithm invention is itself a significantly important process of "doing mathematics"

Create a positive and supportive environment for student-invented strategies

Use and have models available -- with various ways to record thinking

Strategies for Addition and Subtraction

- Distance up or down
- Number lines
- Regrouping
- Encourage strategies that work both right to left or left to right
- For subtraction, anticipate difficulties with 0
- Address difficulties with models

Traditional Algorithms

DELAY directly teaching traditional algorithms (do it last)

Why?

Insist that students be able to explain WHY any algorithm works

Strategies for Multiplication

- Models
  - Repeated addition models
  - Area model
- Partitioning strategies (distributive property)
  - Partial products
- Compensation strategies (distributive property)
  - Traditional algorithm
- Lattice multiplication
Strategies for Division
- Missing factor
- Repeated subtraction
- NOT the traditional long division algorithm (maybe later)

How does using flexible and student-invented computational strategy impact computational estimation skills?

Supporting Estimation
- Flexible methods not answers
- Over or under?

Estimation Strategies
- Front end
- Rounding
- Compatible numbers
- Clustering