How to Survive Teaching
“Mathematics for Elementary Teachers”

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The Stages of Development of a Teacher

The Computational Skills Assessment

The Assessment’s Results
Implications about students
The two modes

What does this suggest? A different approach for both modes
- Going for a profound arithmetical understanding
- MSEB’s “Mathematical Proficiency”
- Maslow’s Hierarchy of Human Needs

“The Enemy of the Best is the Good”
79 Topics in 15 Weeks?
OECD’s Six Big Ideas of Mathematical Content or
Rocks in a Jar

Approach to Content
Structure
Mathematical Connections

Approach to Student Learning
NCTM’s Process Standards
NRC’s Seven Principles of Human Learning

What is Mathematical Understanding?
Maslow’s Hierarchy of Human Needs

1. Survival Needs - food, drink, shelter, warmth, sleep


3. Emotional Needs - sense of belonging and love in work group, family, relationships

4. Esteem Needs - self-esteem, achievement, mastery, independence, status, dominance, prestige, managerial responsibility, influence

5. Self-Actualization Desires - self-fulfillment, seeking personal development

Needs must be satisfied in the given order. Aims and drive always shift to next higher order needs. Levels 1 to 4 are deficiency motivators; level 5 is a growth motivator and relatively rarely found. The thwarting of needs is usually a cause of stress, and is particularly so at level 4. (Abraham Maslow, 1950’s)

We must satisfy each need in turn, starting with the first, which deals with the most obvious needs for survival itself.

Only when the lower order needs of physical and emotional well-being are satisfied are we concerned with the higher order needs of influence and personal development.

Conversely, if the things that satisfy our lower order needs are swept away, we are no longer concerned about the maintenance of our higher order needs.

Examples:

You cannot motivate someone to achieve their thesis (level 4) when they are having problems with their marriage (level 3).

You cannot expect a student to work for achievement (level 4) when they do not feel they belong to a peer group (level 3).
Mathematical Proficiency

Understanding (Conceptual Competence)

Comprehension of mathematical concepts, operations, and relations

Computing (Procedural Fluency)

Skill in carrying out procedures flexibly, accurately, efficiently, and appropriately

Applying (Strategic Competence)

Ability to formulate, represent, and solve mathematical problems

Reasoning (Adaptive Reasoning)

Capacity for logical thought, reflection, explanation, and justification

Engaging (Productive Disposition)

Habitual inclination to see mathematics as sensible, useful, and worthwhile, coupled with a belief in diligence and one's own efficacy

The Six Big Ideas of Mathematical Content

- Chance
- Change and Growth
- Space and Shape
- Quantitative Reasoning
- Uncertainty
- Dependency and Relationships

The Five Deep Mathematical Ideas

- Dimension
- Quantity
- Uncertainty
- Shape
- Change

Learning with Understanding:
Seven Principles of Human Learning

National Research Council

Principle 1: Principled Conceptual Knowledge

Learning with understanding is facilitated when new and existing knowledge is structured around the major concepts and principles of the discipline.

Principle 2: Prior Knowledge

Learners use what they already know to construct new understandings.

Principle 3: Metacognition

Learning is facilitated through the use of metacognitive strategies that identify, monitor, and regulate cognitive processes.

Principle 4: Differences Among Learners

Learners have different strategies, approaches, patterns of abilities, and learning styles that are a function of the interaction between their heredity and their prior experiences.

Principle 5: Motivation

Learners' motivation to learn and sense of self affects what is learned, how much is learned, and how much effort will be put into the learning process.

Principle 6: Situated Learning

The practices and activities in which people engage while learning shape what is learned.

Principle 7: Learning Communities

Learning is enhanced through socially supported interactions.