Teaching for Understanding & Application

A Major Challenge for Physics Teachers

What does it mean for Physics Students “to Understand?”

• Think about, and write about, this by yourself for 10 minutes.

• Then talk about this in groups of 3 - 4 people for 10 minutes

• Each group give a short report for others and for me.

Key points from writing and discussion about Understanding
From recent writings

• In Martha Stone Wiske’s book, *Teaching for Understanding*, David Perkins provides the following definition of understanding: “the ability to think and act flexibly with what one knows” (Wiske, p. 40).

More from David Perkins

“First to gauge a person’s understanding at a given time, ask the person to do something that puts the understanding to work – explaining, solving a problem, building an argument, constructing a product. Second, what learners do in response not only shows their level of current understanding, but very likely advances it” (Wiske, p 41).

Teaching for Understanding Requires a Major Paradigm Shift

• New beliefs about knowledge, curriculum, learning, teaching, and assessment
• New approaches to teaching
• New ways of interacting with students
• New skills and techniques
• New use of teaching time
Teaching for understanding

• Often referred to as
CONSTRUCTIVIST TEACHING or
CONSTRUCTIVIST PEDAGOGY

• This is a complex process

• I hope to make Teaching for Understanding
a little more comprehensible during this
session

Mercedes Model - Gallagher

Different Methods for Different Goals

Building S” Base of Information
Learning facts & concepts
Family teacher-centered method
• Listening
• Reading
• Taking Notes
• Memorizing
• Cookbook Labs
Testing recall of facts & concepts

Developing Understanding
Making sense/inter-relating concepts
New methods of active learning
• Writing
• Group discussion
• Presentations
• Experiments
• Investigative Labs
Assessing understanding

Applying Knowledge
Applying concepts to real problems
Enrichment of methods beyond the classroom
• Practical application
• Aid word environments
• Aid self-learning
• Explaining applications
• Solving real-life problems
Assessing problem-solving/applications
Building Ss’ Information Base

- Teachers are skilled in achieving this
- It involves traditional pedagogy
  - Lecture to transmit information
  - Reading text, watching videos, hands-on
  - Objective Tests
- It is a very important part of development of understanding
- However it is not the endpoint

Developing Understanding

- Formulating explanations, grounded in experience
- Multiple ways of representing ideas
- Writing and drawing to learn
- Group discussion
- Public presentations that include descriptions & explanations
- Investigative labs
- Continuous assessment to check Ss’ progress toward understanding

Applying Knowledge

- Goals of Application
  - Practical Applications
  - Applications that aid understanding
  - Applications to subsequent learning
- Explaining Applications
- Solving Real Problems
- Assessing Problem Solving & Applications
Developing Understanding & Application of Science Knowledge

• Requires long-term engagement by students in activities that foster sense-making and making connections
• Requires continuous assessment to ensure that they do not form misconceptions
• Teachers must guide these two processes:
  – Activities that foster understanding
  – Continuous assessment

Planning Lessons that Teach for Understanding & Application

• Include activities that address the key parts of teaching for understanding & application
  – Building the information base
  – Developing understanding
  – Applying knowledge
  – Using continuous, embedded assessment throughout to assure intended progress occurs

The key pitfalls are

• Inattention to parts 2, 3, & 4 -- the new pedagogy
• Over attention to building the information base -- the old familiar pedagogy
• Balance is needed between the old & new
  – More equal time for each column in slide 9

INFORMATION BASE - UNDERSTANDING -- APPLICATION & the methods and techniques associated with each
Developing Understanding & Application of Science Knowledge
• Requires specialized teaching strategies
• Requires slowing the pace of content coverage
• But why “cover” content when students fail to understand and cannot use the knowledge?

Teaching for Understanding & Application of Science Knowledge
• Is a central part of the reform in science
• It deserves to be at the center of our thoughts, plans and actions so that we learn how achieve this reform goal and actually achieve it at all levels of science teaching from K - University!

Using Slide 9 as a basis
• Work in groups of 3 - 5 at similar grade levels
• Pick a topic that you teach, and
• Design a lesson sequence (2 - 5 class periods) that includes all three elements of Slide 9 (Building Knowledge Base, Developing Understanding, and Application)
Schedule

• Work for about 45 minutes in groups
• Prepare 5 minute oral report for your work
• Present to group
• Whole group discussion
  – Benefits of teaching for understanding
  – Difficulties in teaching for understanding in physics classes