

## **Explanations in the Sciences**

Britt Argow     argow@pangea

Meg Wilcy     mcgw@leland

**The Problem:** The material in science and engineering courses is difficult for students to understand and absorb because of the

- sequential or hierarchical nature of the material.
- large number of technical or specialized terms, concepts, theorems, laws, rules, criteria, and processes, and the interrelationships among them.
- abstractness and non-intuitiveness or even counter-intuitiveness of some concepts.
- complexity and length of explanations.
- condensed nature of the material presented in a lecture.
- variety of facets of knowledge to be acquired.
- need to apply the theoretical material to non-routine problem-solving.

**The Abstract Solution:** Teach with Clarity

Successful teachers bring clarity to their explanations by

- building the explanation in a logical, structured sequence
- simplifying the explanation
- avoiding “noise” in explaining
- adapting the explanation to the students
- sharpening the meaning of the new concepts and procedures

**The Practical Solution Part I:** Techniques for simplifying explanations

Simplify the first explanation—present first (or solely) a simplified version

- present first the core notion or the end result
- present first a rough notion
- present first a visual or intuitive interpretation
  - two-dimensional visual representations: graphs, drawings, charts, diagrams, or pictures
  - three-dimensional visual representations: concrete objects or three-dimensional physical models
  - technology-based visual representations
- present a simpler case of the topic
  - without the mathematics
  - only the mathematics
  - a numeric or concrete example .
- present first an analogy or metaphor
  - a similar case of the same domain
  - a similar case of another domain
  - a case related to students’ life experiences

Simplify an explanation after it has been taught

- provide an algorithm or plan for action
- simulate the process or review the steps
- stress again the core idea or the main points
- demonstrate solutions