

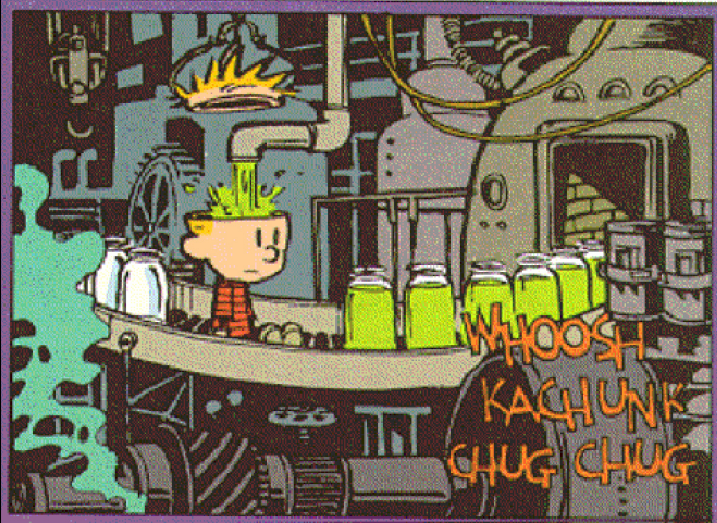
DAY 2 – THE PROBLEM WITH TRADITIONAL APPROACHES

Physics Teaching and Learning Course – Fall 2015

MODELS OF UNDERSTANDING

- Implicit, not evidence based, intuitive, emotionally based.
- Traditional Model of Education
 - Teacher knows more than student.
 - Teacher tells students what they should learn in a clear organized way.
 - Students hear teacher and now they share the same knowledge.
 - Teacher thinks students are now experts.
 - Students fail tests, feel frustrated, are unhappy, leave physics (especially women and URM's), spend the rest of their lives at cocktail parties telling anyone in physics how much they hated it, etc.
 - Teacher wonders what happened, blames students for being unprepared or unmotivated.
 - Teacher repeats.

TRANSMISSIONIST TEACHING



Teacher-Centered: Based on how teacher thinks about content and teachers interests, what teacher has decided is important.

Focus is on teaching not learning: Teaching is not impacted by what is going on for students.

Passive Students: Students receive information.

Outcomes: Low levels of learning and decreasing interest.

ASSESSING CONCEPTUAL MASTERY

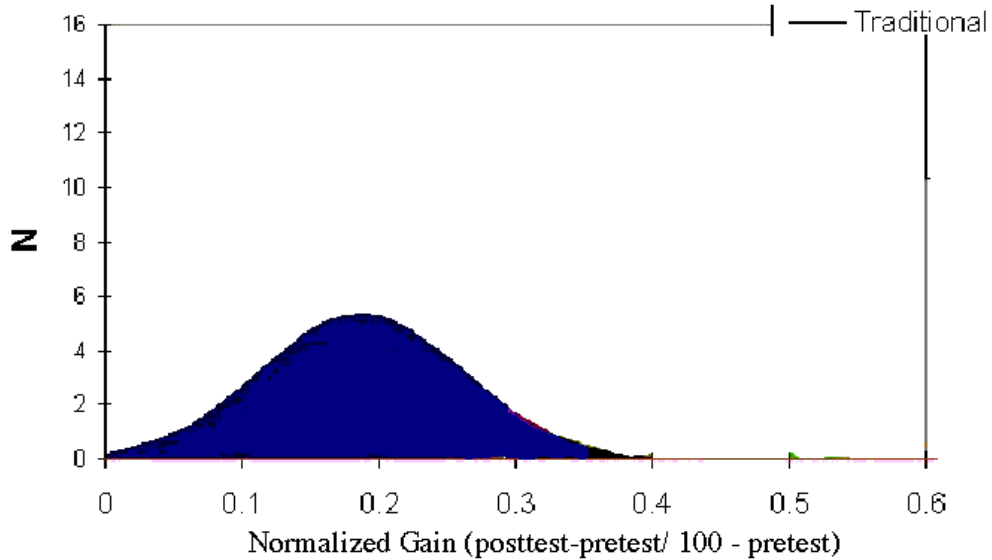
Force Concept Inventory

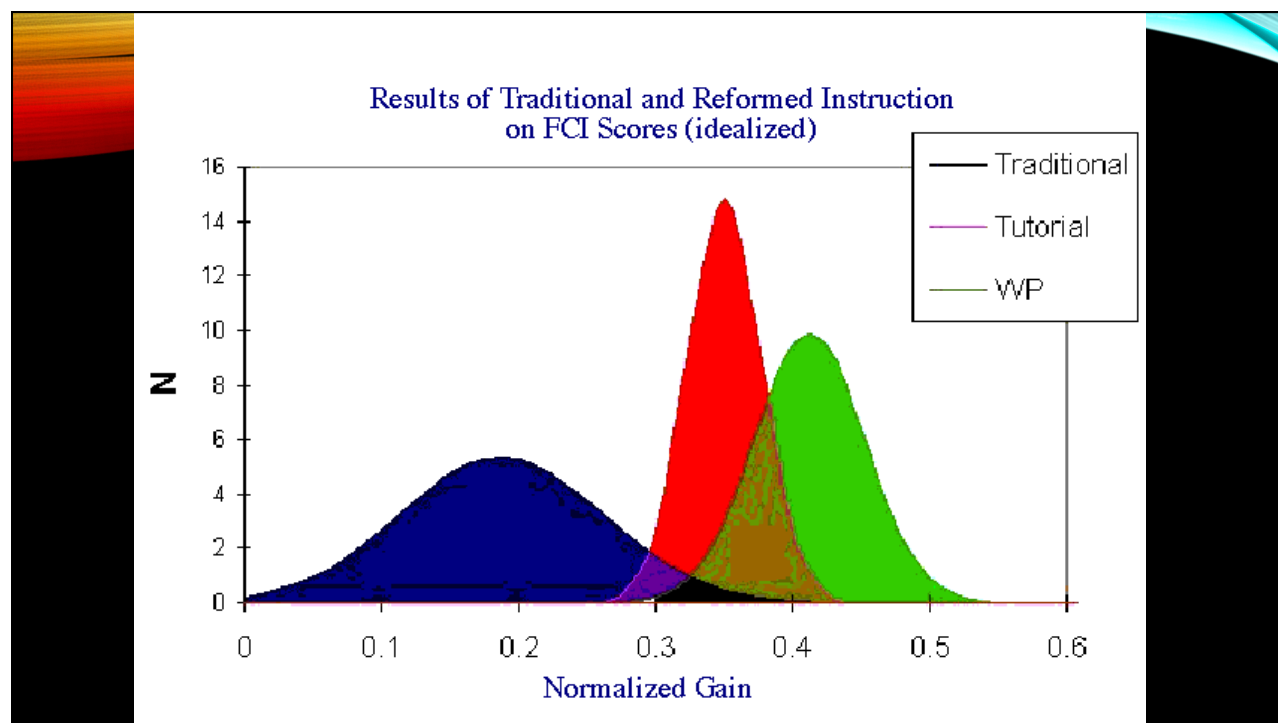
The *Force Concept Inventory* (FCI) is a multiple-choice "test" designed to assess student understanding of the *most basic* concepts in Newtonian mechanics. The FCI can be used for several different purposes, but the most important one is to evaluate the effectiveness of instruction. For a full understanding of what has gone into the development of this instrument and how it can be used, the FCI manual ² should be consulted, as well as (a) the

FCI EXAMPLE QUESTION

4. A large truck collides head-on with a small compact car. During the collision:
- (A) the truck exerts a greater amount of force on the car than the car exerts on the truck.
 - (B) the car exerts a greater amount of force on the truck than the truck exerts on the car.
 - (C) neither exerts a force on the other, the car gets smashed simply because it gets in the way of the truck.
 - (D) the truck exerts a force on the car but the car does not exert a force on the truck.
 - (E) the truck exerts the same amount of force on the car as the car exerts on the truck.

Results of Traditional Instruction
on FCI Scores





ATTITUDES AND BELIEFS*

Assessing the “hidden curriculum” - beliefs about physics and learning physics

Examples:

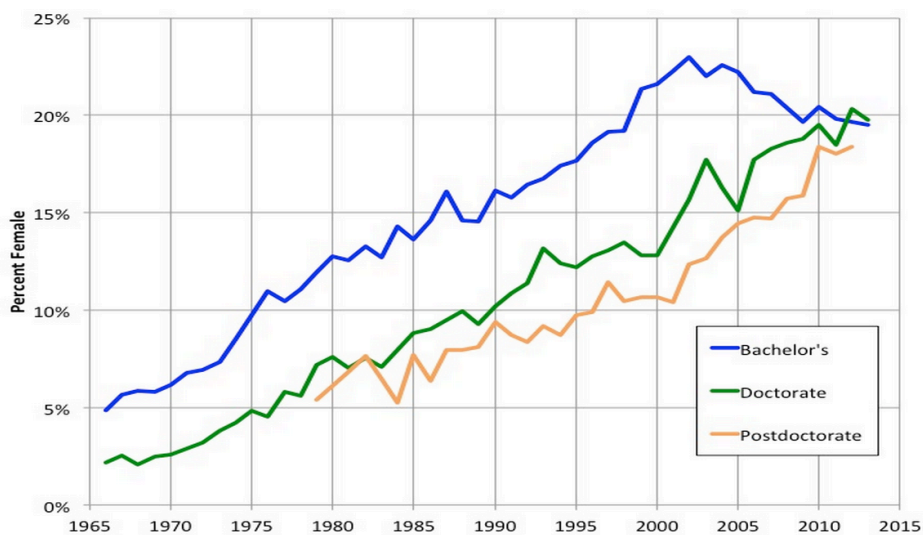
- “I study physics to learn knowledge that will be useful in life.”
- “To learn physics, I only need to memorize solutions to sample problems”

*Adams et al, (2006). Physical Review: Spec. Topics: PER, 0201010

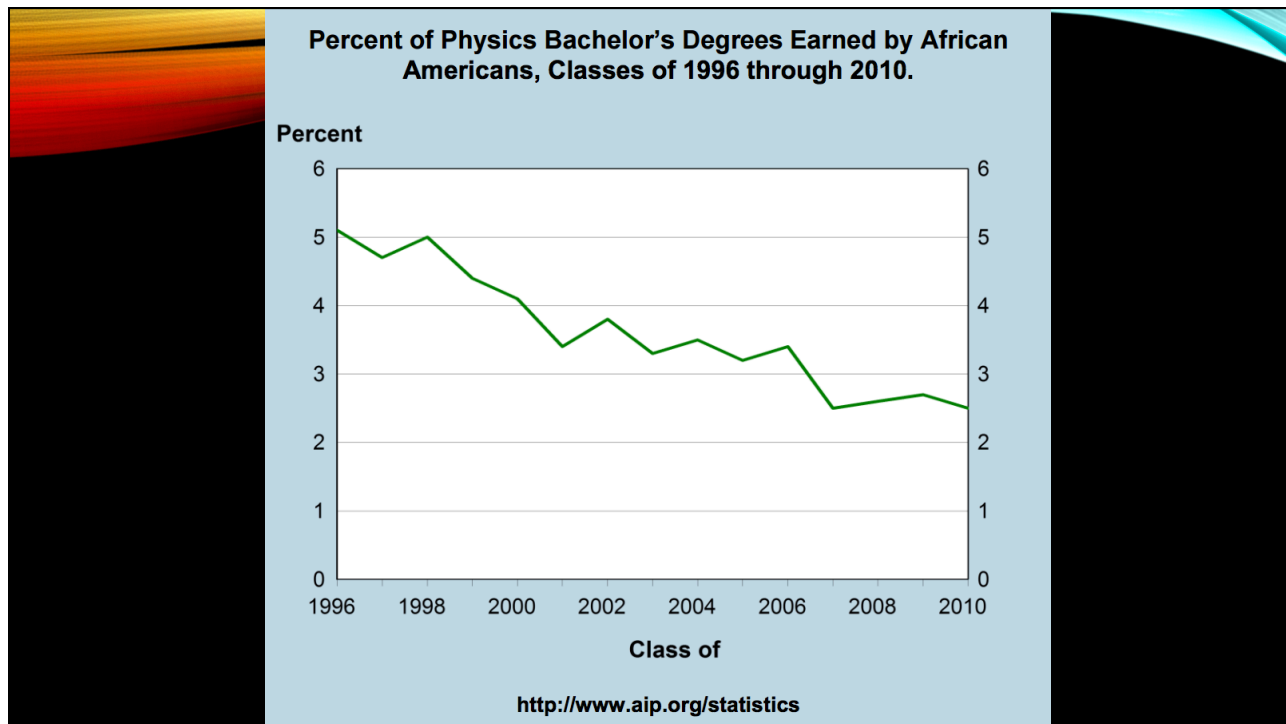
CLASS CATEGORIES

	Shift (%) ("reformed" class)
Real world connect...	-6
Personal interest.....	-8
Sense making/effort...	-12
Conceptual.....	-11
Math understanding...	-10
Problem Solving.....	-7
Confidence.....	-17
Nature of science.....	+5
	(All $\pm 2\%$)

Percentage of Women in Physics



Credit: APS/Source: IPEDS Completion Survey & NSF-NIH Survey of Graduate Students & Postdoctorates in Science and Engineering



IS LECTURE ALWAYS BAD?