Physics 20 and 40 series

Tutorials in Discussion Sections
Frequently Asked Questions

In discussion sections, you will be working on Tutorials in a group of 3-4 classmates. Since this is different from a more traditional discussion section in which the TA works out problems on the board, here are a few answers to some common questions about Tutorials. Some of these answers are adapted from a CU-Boulder webpage,[1] where you can learn more about Tutorials.

Where do Tutorials come from?

Tutorials are based on two decades of Physics Education Research. They originally came from a physics education research group at U. Washington, that spent years interviewing students in introductory physics courses at UW, learning about common student conceptual difficulties. These Tutorials have been constructed, studied, and revised over many years. (Almost every week's Tutorial is the result of roughly a third of a PhD student's thesis!) Today Tutorials are used at many universities across the country.

What is the motivation for Tutorials?

Tutorials emphasize concepts and “sense-making”. We care a lot about problem solving in this course, but to solve problems well you can’t just pick an equation and substitute a bunch of numbers for variables. You need to understand the physics principles at work. That’s what Tutorials are designed to help you do. Also, Tutorials emphasize discussion and teamwork, which is good preparation for life after Stanford, when you will probably spend a lot more time working in teams than sitting in lectures.

Why doesn’t my TA just teach me?

Learning physics comes from you; it is not something "transferred into you." This is true of all higher level learning, not just physics. It’s hard to become a good violinist by watching someone play the violin, and it’s hard to develop a deep understanding of physics by watching someone else solve physics problems. Tutorials are designed to get you actively involved, reasoning through problems, convincing your neighbors, and being convinced by them. You will likely discover that you understand an idea much better after you have explained it to a classmate. The best way to learn is to teach.

How can Tutorials help me on the exams or homework, where the questions seem so different?

To do well on homework or exam problems, you need to understand physics principles so that you can identify relevant factors, predict expected behavior, and choose an approach to a solution. Tutorials are designed to build this kind of deep understanding. Moreover, on each exam and homework set, there will be at least one problem written to directly probe your understanding of the concepts explored in the Tutorials. Your work on the Tutorials will help you with these conceptual problems and will also help you think strategically about how to solve more calculation-intensive problems.

[1] http://www.colorado.edu/physics/phys1120/phys1120_fa07/tut2.html

Is there any evidence that Tutorials work better than traditional discussions?
Yes, research shows that students learn more in Tutorial discussions. Here are two published studies, from U. Maryland and Harvard, which both show that students in Tutorial discussions outperform students in traditional recitations. Normalized gain is a measure of the improvement of students' post-course scores over their pre-course scores (the higher the better): g = (post-pre)/(100-pre).

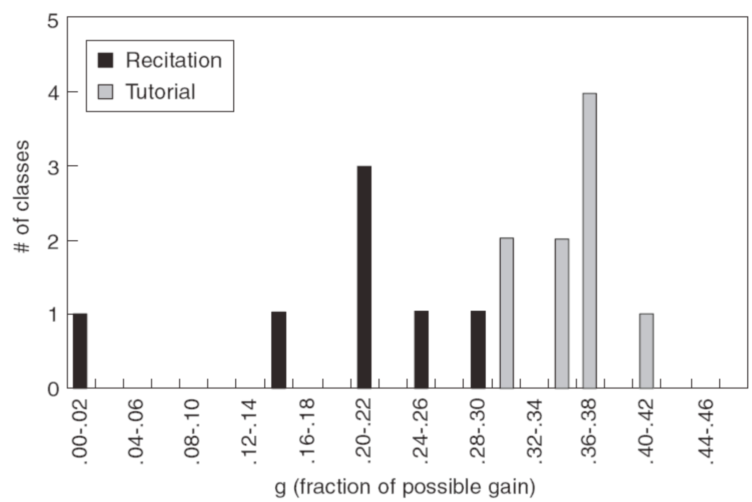
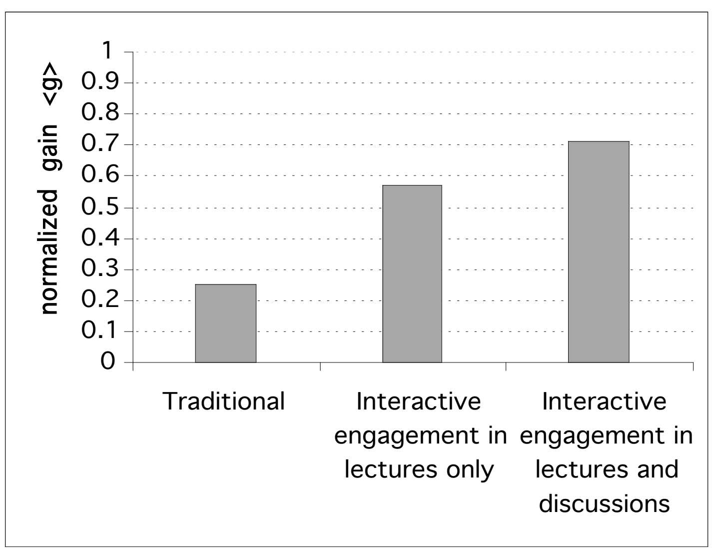


Figure 8.3 Fraction of the possible gain attained by engineering physics students at the University of Maryland in classes taught with traditional recitations (dark) and tutorials (light).

Source: E. Redish, *Teaching Physics with the Physics Suite*, p. 151.



Effect of instructional approach on the normalized pre- to post-test gain <g> on the Force Concept Inventory test for students (N=1123) in introductory calculus-based physics courses at Harvard University. Interactive engagement included "peer instruction" in lectures (responding to 'clicker' questions) and Tutorial group activities in discussion sections. Source: C. Crouch and E. Mazur, *Am. J. Phys.*, **69**, 970-977 (2001).