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PEER INSTRUCTION

One problem with conventional teaching lies in the presentation of the material. Frequently, it comes straight out of textbooks and/or lecture notes, giving students little incentive to attend class. That the traditional presentation is nearly always delivered as a monologue in front of a passive audience compounds the problem. Only exceptional lecturers are capable of holding students' attention for an entire lecture period. It is even more difficult to provide adequate opportunity for students to critically think through the arguments being developed. Consequently, lectures simply reinforce students' feelings that the most important step in mastering the material is solving problems. The result is a rapidly escalating loop in which the students request more and more example problems (so they can learn better how to solve them), which in turn further reinforces their feeling that the key to success is problem-solving.

WHY LECTURE?

The first time I taught introductory physics, I spent a lot of time preparing lecture notes, which I would then distribute to my students at the end of each lecture. The notes became popular because they were concise and provided a good overview of the much more detailed information in the textbook.

Halfway through the semester, a couple of students asked me to distribute the notes in advance so they would not have to copy down so much and could pay more attention to my lecture. I gladly obliged, and the next time I was teaching the same course, I decided to distribute the collected notes all at once at the beginning of the semester. The unexpected result, however, was that a number of students complained on their end-of-semester questionnaires that I was lecturing straight out of my lecture notes!

Ah, the ungratefulness! I was at first disturbed by this lack of appreciation but have since changed my position. The students had a point: I was indeed lecturing from my lecture notes. And research showed that my students were deriving little additional benefit from hearing me lecture if they had read my notes beforehand. Had I lectured not on physics but, say, on Shakespeare, I would certainly not spend the lectures reading plays to the students. Instead, I would ask the students to read the plays before coming to the lecture and I would use the lecture periods to discuss the plays and deepen the students' understanding of and appreciation for Shakespeare.

In the years following the eye-opening experience described in Chapter 1, I explored new approaches to teaching introductory physics. In particular, I was looking for ways to focus attention on the underlying concepts without sacrificing the students' ability to solve problems. The result is *Peer Instruction*, an effective method that teaches the conceptual underpinnings in introductory physics and leads to better student performance on conventional problems. Interestingly, I have found this new approach also makes teaching easier and more rewarding.

The improvements I have achieved with *Peer Instruction* require the textbook and the lectures to play roles different from those they play in a conventional course. Preclass reading assignments from the book first introduce the material. Next, lectures elaborate on the reading, address potential difficulties, deepen understanding, build confidence, and add additional examples. Finally, the book serves as a reference and a study guide.

THE CONCEPTEST

The basic goals of *Peer Instruction* are to exploit student interaction during lectures and focus students' attention on underlying concepts. Instead of presenting the level of detail covered in the textbook or lecture notes, lectures consist of a number of short presentations on key points, each followed by a *ConcepTest*—short conceptual questions on the subject being discussed. The students are first given time to formulate answers and then asked to discuss their answers with each other. This process (*a*) forces the students to think through the arguments being developed, and (*b*) provides them (as well as the teacher) with a way to assess their understanding of the concept.

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