

Peer Instruction: Ten years of experience and results

Catherine H. Crouch and Eric Mazur

Department of Physics, Harvard University, Cambridge, Massachusetts 02138

We report data from ten years of teaching with Peer Instruction (PI) in the calculus and algebra based introductory physics courses for nonmajors; our results indicate increased student mastery of both conceptual reasoning and quantitative problem solving upon implementing PI. We also discuss ways we have improved our implementation of PI since introducing it in 1991. Most notably, we have replaced in-class reading quizzes with pre-class written responses to the reading, introduced a research-based mechanics textbook for portions of the course, and incorporated cooperative learning into the discussion sections as well as the lectures. These improvements are intended to help students learn more from pre-class reading and to increase student engagement in the discussion sections, and are accompanied by further increases in student understanding.

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I. INTRODUCTION

In recent years, physicists and physics educators have realized that many students learn very little physics from traditional lectures. Several investigators have carefully documented college physics students' understanding of a variety of topics, and have concluded that traditionally taught courses do little to improve students' understanding of the central concepts of physics, even if the students successfully learn problem-solving algorithms. Simultaneously, authors studying learning in higher education have established that students develop complex reasoning skills most effectively when actively engaged with the material they are studying, and have found that cooperative activities are an excellent way to engage students effectively. In response to these findings, many pedagogies have been devised to improve student understanding of physics, ranging from modifications of traditionally taught courses to complete redesign of courses

Here we present the results of ten years of teaching the two introductory physics courses for nonmajors at Harvard University with one such method, Peer Instruction. Peer Instruction modifies the traditional lecture format to include questions designed to engage students and uncover difficulties with the material. Peer Instruction has also been used successfully at many other institutions and in upper-level courses; those results are described elsewhere.

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