

Abstract for an Invited Paper
for the MAR09 Meeting of
The American Physical Society

Innovations in Teaching with Computers: What Works, What Doesn't, and How We Can Tell

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Over the past few decades, members of the physics education community, including researchers in physics education, have been actively developing an ever-expanding array of computer-based tools with which to improve the effectiveness of physics teaching. The 2008 Gordon Research Conference (GRC) on Physics Research and Education served to showcase several such examples of incorporating computation into the undergraduate physics curriculum. In light of these recent advances, it has become increasingly important to ask what it means for such innovations to “work” and what evidence is needed to assess whether or not such innovations “work” as intended. This presentation will provide an overview of several interrelated themes from the 2008 GRC that currently drive efforts in research and curriculum development. These themes include: How can computer-based modeling, interactive simulations and visualizations, and virtual experimentation enhance student learning of physics? How can these techniques be employed to improve the ability of students to design, perform, and learn from physical experiments? How are physics education researchers utilizing computer-based tools to probe student understanding, characterize student thinking about “what it means to learn physics,” and to develop new innovations?