

Abstract for an Invited Paper
for the TSS09 Meeting of
The American Physical Society

Because physics majors have conceptual difficulties too: Development of a tutorial approach to teaching intermediate mechanics

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Ongoing research in physics education has demonstrated that physics majors often do not develop a working knowledge of basic concepts in mechanics, even after standard instruction in upper-level mechanics courses.¹ A central goal of this work has been to explore the ways in which students make— or do not make—appropriate connections between physics concepts and the more sophisticated mathematics (e.g., differential equations, vector calculus) that they are expected to use. Analysis of results from pretests (ungraded quizzes), written exams, and informal classroom observations will be presented to illustrate examples of specific conceptual and reasoning difficulties that students typically encounter. This work has motivated the need for alternative approaches to instruction in intermediate mechanics, and evidence of the effectiveness of a tutorial approach (using Intermediate Mechanics Tutorials²) will be presented. (These tutorial materials will also serve as the focus of a workshop to be offered later in the day.) 1. B.S. Ambrose, “Investigating student understanding in intermediate mechanics: Identifying the need for a tutorial approach to instruction,” *Am. J. Phys.* 72, 453- 459 (2004). 2. Supported by NSF grants DUE-0441426 and DUE-0442388.