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Challenges in enhancing student learning in intermediate mechanics: Identifying the need for a tutorial approach to instruction

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One area of ongoing physics education research at Grand Valley State University is to probe the conceptual understanding and reasoning skills of advanced undergraduates as they make the transition from a traditional sequence in introductory calculus-based physics to their first course in upper-level mechanics. [1] The results thus far are consistent with findings from other investigations in upper division courses, which indicate that persistent difficulties with fundamental concepts can hinder meaningful learning of advanced topics. To address this problem, the tutorial approach developed at the University of Washington [2] is being adapted and incorporated into the intermediate mechanics course. Evidence from ungraded quizzes (pretests) and course exams will be presented to illustrate the presence of specific difficulties and the effectiveness of the modified instructional approach. [1] B.S. Ambrose, *Am. J. Phys.* **72** (4), 453 – 459 (2004). [2] L.C. McDermott, P.S. Shaffer, and the Physics Education Group at the University of Washington, *Tutorials in Introductory Physics* (Prentice-Hall, Upper Saddle River, NJ, 2002).