

Title: Helping traditionally under-served populations by changing the pedagogy of introductory physics

Abstract: Two major changes made to instruction in the calculus-based introductory physics sequence at the University of Kansas over the past ten years have improved student performance. First, by switching to a competency-based grading system in these classes we have reduced the drop/fail/withdrawal rates and course-associated grade penalties of under-represented minority, first generation, and female students. Second, we have shifted the initial focus of instruction away from forces and the associated vector mathematics, which are known to be problematic for students, to the scalar quantity energy, which is more closely aligned with their previously established intuition, and associated differential and integral calculus. A subsequent longitudinal study demonstrated that implementation of this calculus-enhanced “energy-first” curriculum improved performance in downstream engineering courses for students with lower ACT math scores.

Bio: Christopher Fischer is the Director of Engineering Physics and the Associate Chair in the Department of Physics and Astronomy at the University of Kansas. He has a BA in Physics from Washington University in St. Louis and a Ph.D. in Applied Physics from the University of Michigan. In addition to physics education research, he also maintains an active biophysics program centered on developing kinetic and thermodynamic descriptions of the function of nucleic acid interacting molecular motors.