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A Flipped Pedagogy for Expert Problem Solving

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The internet provides free learning opportunities for declarative (Wikipedia, YouTube) and procedural (Kahn Academy, MOOCs) knowledge, challenging colleges to provide learning at a higher cognitive level. Our "Modeling Applied to Problem Solving"[1] [2] pedagogy for Newtonian Mechanics imparts *strategic knowledge* - how to systematically determine which concepts to apply and why. Declarative and procedural knowledge is learned online before class via an e-text, checkpoint questions, and homework on edX.org (see http://relate.mit.edu/physicscourse); it is organized into five Core Models. Instructors then coach students on simple "touchstone problems", novel exercises, and multi-concept problems - meanwhile exercising three of the four C's: communication, collaboration, critical thinking and problem solving. Students showed 1.2 standard deviations improvement on the MIT final exam after three weeks instruction, a significant positive shift in 7 of the 9 categories in the CLASS, and their grades improved by 0.5 standard deviation in their following physics course (Electricity and Magnetism).

[1]Modeling Applied to Problem Solving, Pawl, A., et. al. ,*AIP Conference Proceedings* 1179 2009 Physics Education Research Conference, pp. 51-54, (2009)

[2]Improved Student Performance In Electricity And Magnetism Following Prior MAPS Instruction In Mechanics, Rayyan, S eet. al. Physics Education Research Conference 2010 AIP Conf. Proc. 1289, 273(2010).