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New Pedagogy in Introductory Physics and Upper-level AMO Courses[1]

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In recent decades the need for science education has expanded in its scope and grown in its importance. We need to reevaluate science teaching to see how it can better meet these needs. Scientists often abandon the powerful intellectual tools they routinely use in their science when they go to teach science. They fall back on tradition and highly subjective judgments of the instructor (known in other contexts as "superstition). I will discuss the advantages of approaching the teaching of physics like a physics experiment. This approach includes: collecting and utilizing valid quantitative data (both ones own and those from the research of others), using quantitative statistical analysis to extract information from experiments involving imperfectly controlled degrees of freedom, and taking advantage of useful new technology. This discussion will include a review of some of the key findings of researchers about how people learn in general and how they learn physics specifically, and how these findings can be used to improve teaching practices. As time permits, I will also cover some surprising results my education research group has found on the study of how student beliefs shape and are shaped by their physics classes and the effective use of technology.

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