Using physics education research to set the goals of physics courses and design and study the outcomes of interventions

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Physics education research (PER) is an interdisciplinary field that studies how p eople learn physics with the goal of improving this learning process for all students. In order to achieve this goal we need to define operationally what it means to learn physics, devise assessment instruments to evaluate this learning and develop curriculum materials that will lead to desired learning outcomes.

For decades PER was focused on student learning of the final outcomes of physics as a science - concepts and mathematical representations without paying much attention to the *process* though which physicists develop these concepts and representations.

However, this missing part of learning physics and evaluating physics education is crucial if we wish to grow independent thinkers and prepare them to be successful in the 21st century. In my talk I will describe several non-traditional PER studies that show how to integrate this "missing" part of physics learning into our regular physics instruction and how to assess this different aspect of student learning.