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# Increasing the Impact of PER: Recommendations from Typical Faculty

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#0715698

# The Current Situation

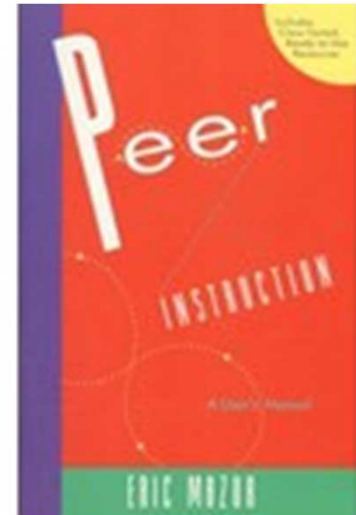
- There are many good PER-based instructional strategies available\*
  - 50% of faculty say that they use at least one
- But
  - Many report implementation difficulties
  - Discontinuation is a problem
  - Few use strategies as recommended by developer
- Big question -> How can PER do a better job of supporting the spread of PER products?
- This talk -> What suggestions do non-PER faculty have about what PER could do better?



\*Henderson, C. & Dancy, M. (2009) [The Impact of Physics Education Research on the Teaching of Introductory Quantitative Physics in the United States](#), *Physical Review Special Topics: Physics Education Research*, 5 (2), 020107.

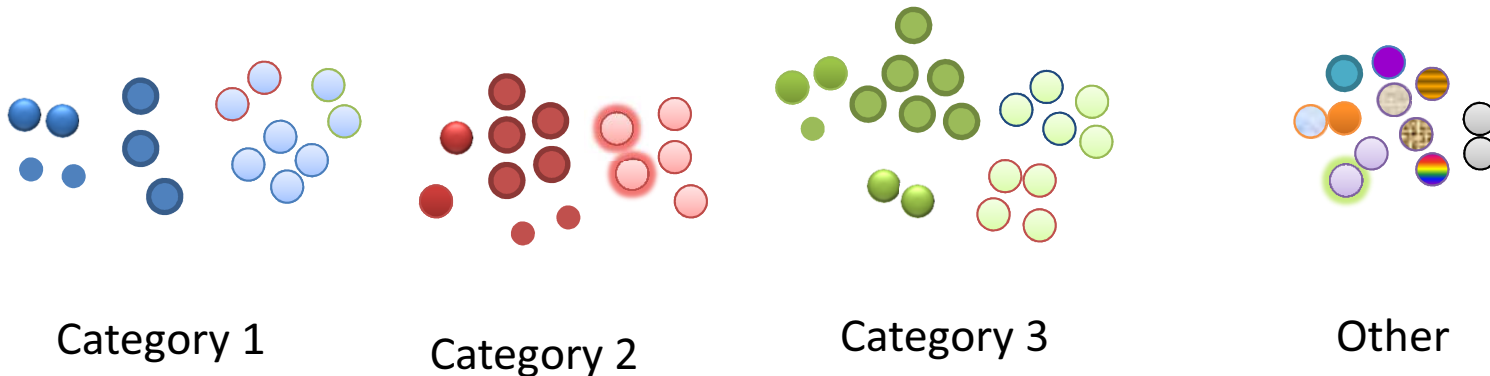
# Data Collection

- Interviews: N=35
  - Level of Use of Peer Instruction
    - High User – uses with fidelity (N=7)
    - Mixed User – uses some features (N=18)
    - Knowledgeable non-user (N=10)
  - Type of Institution
    - Two-year college (N=11)
    - Four-year college (B.A.) (N=12)
    - Four-year college (Grad) (N=12)
- “What would you recommend that the PER community do in order to have a larger impact on the teaching practices of typical physics faculty?”
- 3 faculty had no recommendations and were removed from this analysis



# Analysis

- Identify statements from transcripts with recommendations for PER (N=125)
- Emergent coding scheme
  - Group statements that are similar
  - Cluster groups into categories



# Results

## Main Categories

### 1. Improve Dissemination

PER needs to improve dissemination efforts

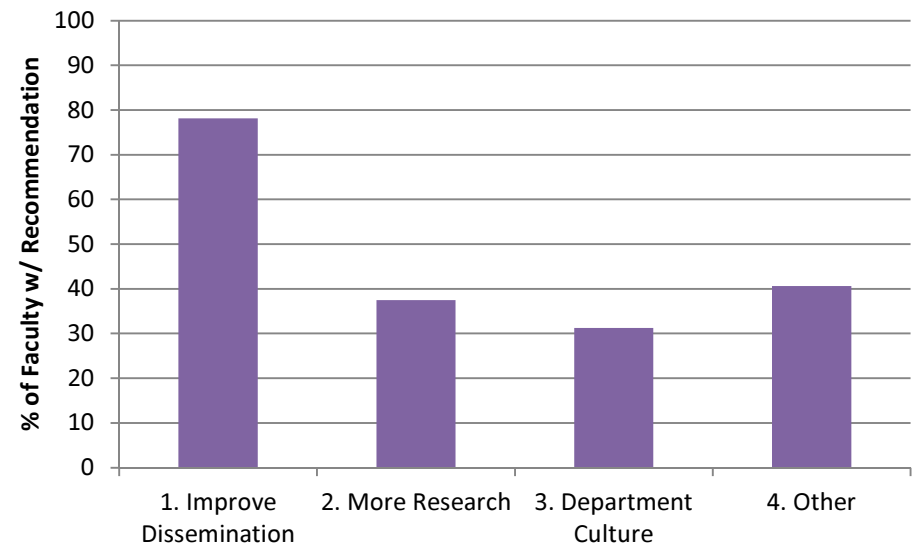
### 2. More Research

More research on PER methods is needed

### 3. Department Culture

PER should focus on impacting department and institutional culture

### 4. Other



# Improved Dissemination

## PER needs to improve dissemination efforts

1. Hard to find PER Stuff (34%)
  - There is so much PER stuff out there and it can be hard to find and sort through.
    - Need easier access to PER materials
    - Need ways to keep up with new ideas
    - Have consultants to recommend solutions to departments
2. Disseminate to support customization (25%)
  - Need to do more to get faculty engaged in thinking about how they could customize a PER product to work for them.
  - Teaching methods need to fit with personality.
3. Higher profile dissemination efforts (22%)
  - e.g., Articles in *Physics Today*

# More Research

## More research on PER methods is needed

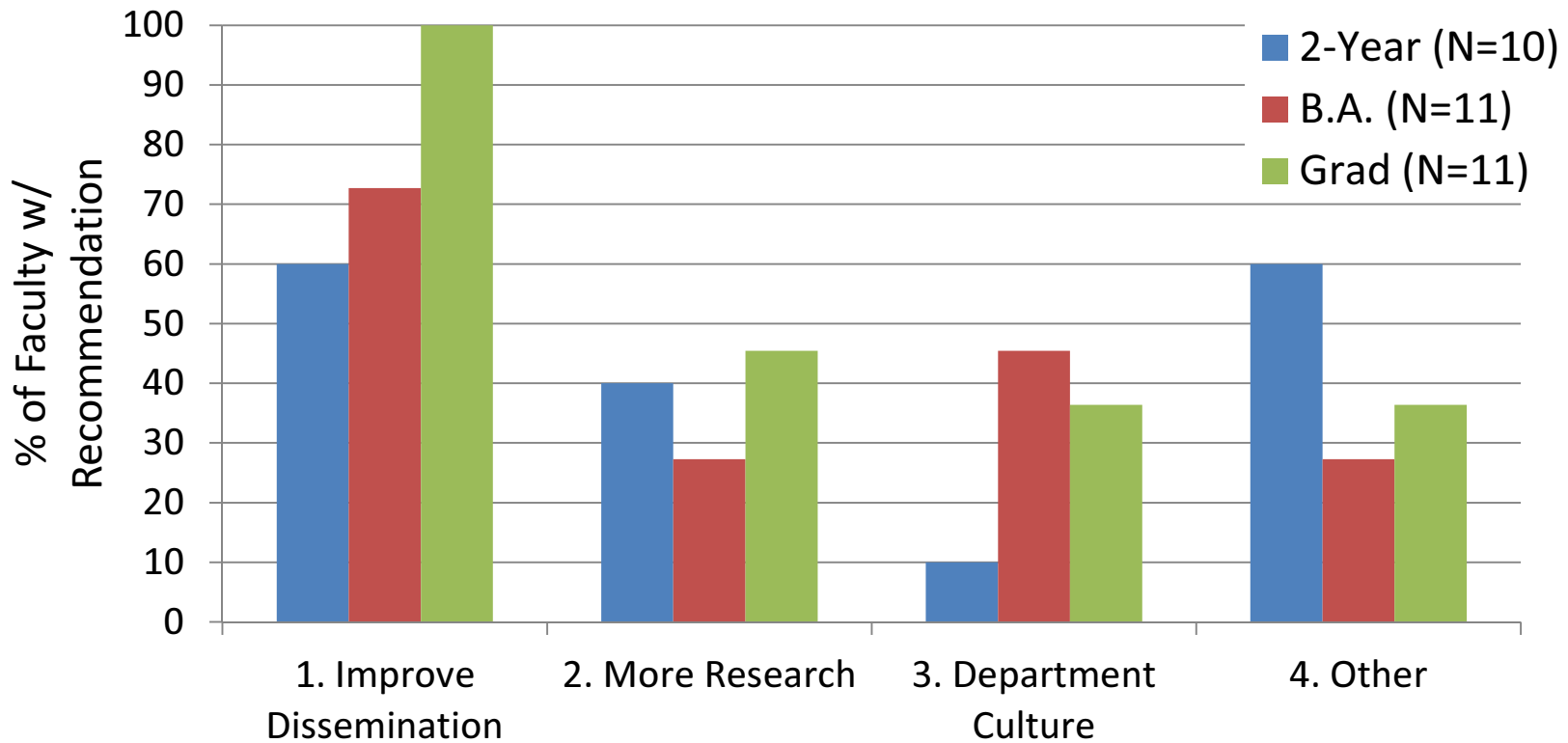
1. PER Results not believable (16%)
  - Assessment methods in PER are biased towards the method being studied
2. How do PER ideas work in different situations? (16%)
  - Much of PER is done at large R1 schools. What about other types of institutions and students?
3. PER should focus beyond conceptual understanding (13%)
  - There are many other important instructional goals, e.g., problem solving

# Department Culture

**PER should focus on impacting department and institutional culture**

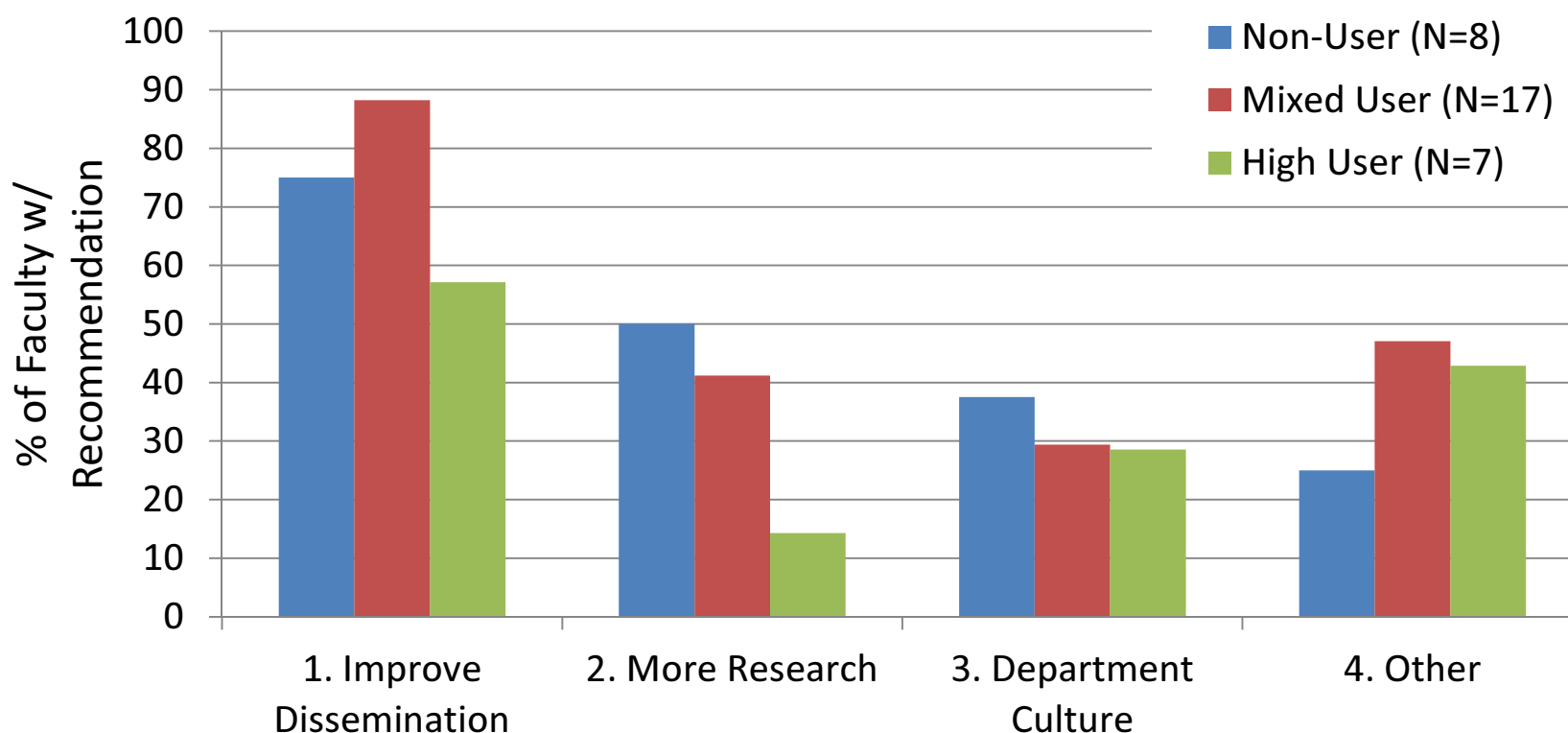
1. Instructional Improvement not valued by departments/institutions (19%)
  - More lobbying departments to support faculty (especially junior) who want to try PER strategies
  - Get institutions to value SoTL
2. Assessment of faculty teaching not based on measures of student learning (9%)
  - Faculty who experiment with PER may get poor teaching evaluations
  - Part of the problem is that research is easier to evaluate than teaching.
3. Other (13%)
  - There a lot of good PER things, but to be most effective the whole department needs to be on board.
  - PER can help with assessment issues (i.e., growing emphasis on assessment)

# Recommendations by Institution Type



- Faculty at grad institutions see dissemination efforts as more problematic than instructors from two-year colleges ( $p=0.035$ , Fisher Exact Test).
- Many (>25%) instructors from B.A. and Grad institutions report that PER needs to address problems with departmental culture.

# Recommendations by User Type\*



- Many (>25%) of PI Non-Users and PI Mixed Users report that PER needs to conduct more research on PER RBIS. This may be less of a concern for High Users (although there is no statistical difference between these groups).

\*User Type is defined based on researchers characterizing interviewee's reported practices.

# Conclusions

Faculty have good ideas! We should listen to them.

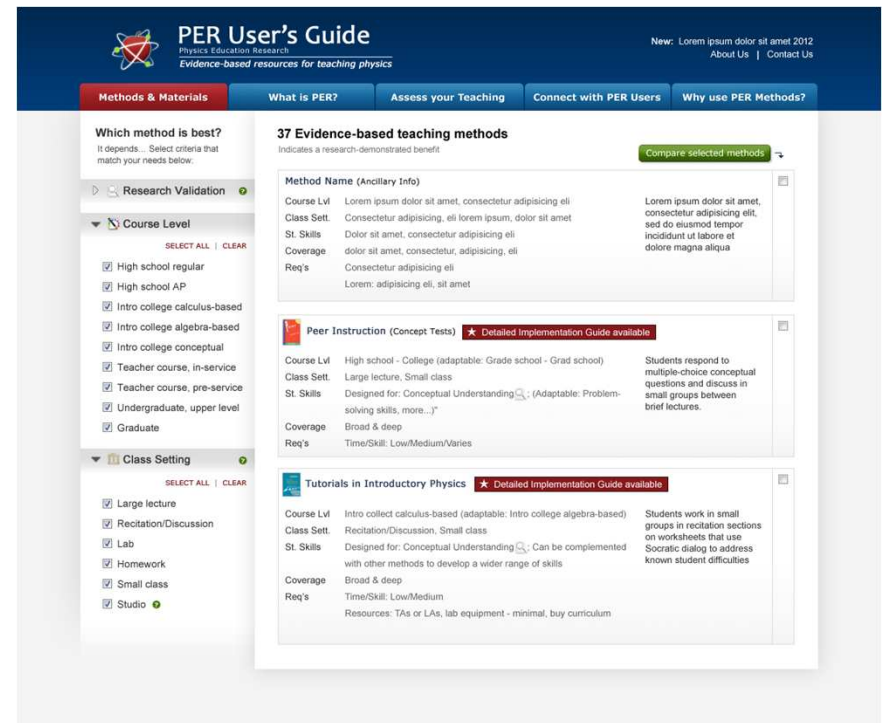


*"I'm glad I put up a suggestion box for my patients, but now I'm a little concerned."*

# Conclusions - Our Recommendations

## Improving Dissemination

- Figure out how to provide user-friendly, convenient access to PER materials
- Customization happens – design to support it.



The screenshot displays the PER User's Guide website. The header includes the logo, the title "PER User's Guide", and the subtitle "Evidence-based resources for teaching physics". A navigation menu contains links for "Methods & Materials", "What is PER?", "Assess your Teaching", "Connect with PER Users", and "Why use PER Methods?". The main content area is titled "37 Evidence-based teaching methods" and features a "Compare selected methods" button. The interface is divided into three columns: a filter sidebar on the left, a central list of methods, and a detailed view of a selected method on the right. The filter sidebar includes sections for "Research Validation", "Course Level", and "Class Setting", each with a list of checkboxes. The central list shows method details such as "Method Name (Ancillary Info)", "Course Lvl", "Class Sett", "St. Skills", "Coverage", and "Req's". The detailed view on the right provides further information for a specific method, including "Peer Instruction (Concept Tests)", "Course Lvl", "Class Sett", "St. Skills", "Coverage", and "Req's".

PER User's Guide being developed by Sam McKagan: [perusersguide.org](http://perusersguide.org)

# Our Recommendations (cont.)

## More Research

- Study secondary implementations (e.g., Sharma et al.)
- Develop assessments that measure things other than student conceptual understanding (e.g., problem solving ability - Docktor and Heller)

PHYSICAL REVIEW SPECIAL TOPICS - PHYSICS EDUCATION RESEARCH 6, 020119 (2010)

### Use of interactive lecture demonstrations: A ten year study

Manjula D. Sharma, Ian D. Johnston, Helen Johnston, Kevin Varvell, Gordon Robertson, Andrew Hopkins, Chris Stewart, Ian Cooper, and Ronald Thornton\*  
*School of Physics, University of Sydney, New South Wales 2006, Australia*  
(Received 1 June 2010; published 8 October 2010)

The widely held constructivist view of learning advocates student engagement via interactivity. Within the physics education research community, several specific interactive strategies have been developed to enhance conceptual understanding. One such strategy, the Interactive Lecture Demonstration (ILD) is designed for large lecture classes and, if measured using specific conceptual surveys, is purported to provide learning gains of up to 80%. This paper reports on learning gains for two different Projects over ten years. In Project 1, the ILDs were implemented from 1999 to 2001 with students who had successfully completed senior high school physics. The learning gains for students *not* exposed to the ILDs were in the range 13% to 16% while those for students exposed to the ILDs was 31% to 50%. In Project 2, the ILDs were implemented from 2007 to 2009 with students who had not studied senior high school physics. Since the use of ILDs in Project 1 had produced positive results, ethical considerations dictated that all students be exposed to ILDs. The learning gains were from 28% to 42%. On the one hand it is pleasing to note that there is an increase in learning gains, yet on the other, we note that the gains are nowhere near the claimed 80%. This paper also reports on teacher experiences of using the ILDs, in Project 2.

DOI: [10.1103/PhysRevSTPER.6.020119](https://doi.org/10.1103/PhysRevSTPER.6.020119)

PACS number(s): 01.40.Fk, 01.40.Di, 01.40.gb

Proceedings of the NARST 2009 Annual Meeting

### ROBUST ASSESSMENT INSTRUMENT FOR STUDENT PROBLEM SOLVING

Problem solving is a complex process that is important for all citizens in our modern world and crucial for learning physics. Although there is a great deal of effort to improve student problem solving throughout the educational system, there is no standard way to evaluate written problem solving that is valid, reliable, and easy to use. Typically complex processes such as problem solving are assessed by using a rubric, which divides a skill into multiple reasonably independent categories and defines criteria to attain a score in each. This paper describes the development and validation of a problem solving rubric for the purpose of assessing written solutions to physics problems.

Jennifer Docktor, University of Minnesota  
Kenneth Heller, University of Minnesota

# Our Recommendations (cont.)

## Department Culture

- Utilize change models that focus on the department level - not individual faculty (e.g., U of IL)
- Help departments and institutions re-think how assessment of teaching effectiveness is done (e.g., Turpen talk & poster)

### Innovations in Undergraduate Physics Education at Illinois

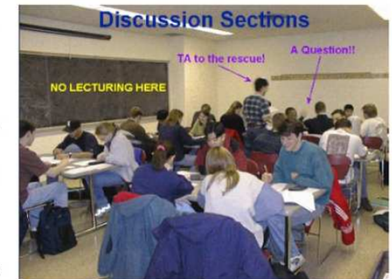


Several recent developments have stimulated our Department of Physics at the University of Illinois at Urbana-Champaign (UIUC) to undertake a major revitalization of our introductory physics curriculum. First, physics education research has provided new insights to radically improve the way we teach physics, and second, the computer revolution has provided new, exciting pedagogical tools. These new capabilities, coupled with the need to provide greater flexibility for our students, and the capability of the World Wide Web to provide an interactive learning environment, have stimulated us to revise completely our introductory courseware. We believe we are establishing a paradigm for science education for the 21st century that develops higher-order thinking competencies, promotes collaborative learning, and improves communication skills.

Over the past few years (Fall 1996 - Spring 2000), both the calculus-based introductory physics sequence (Physics 111-114) and the algebra-based sequence (Physics 101-102) have been completely restructured. These courses are taken by nearly 5000 undergraduate students each year at the UIUC. This fundamental curriculum revision has five overall objectives:

- To "institutionalize" meaningful course content and effective pedagogical methods, so that good teaching is not dependent on a single inspired instructor but is integral to all sections of all classes.
- To incorporate new physics instructional techniques, based on physics education research, that emphasize conceptual understanding.
- To utilize state-of-the-art instructional media, including multimedia lecture presentations, World Wide Web-based interactive course materials, and laboratory computer data acquisition and analysis.
- To develop students' teamwork skills and to promote students' opportunities for collaborative learning.
- To develop a model for basic science teaching that will be "portable" to other departments on our campus and to other physics departments at large research universities.

Well-constructed courses in physics provide the foundation of technical and scientific understanding for most science and engineering students. — "Physics is



### ***Is this Good Teaching? Assessment Challenges for Both Faculty and Institutions***

by Chandra Turpen

Type: Contributed

**AE09**

Mon 08/01, 9:20AM - 9:30AM

As part of a larger research study, we focus on the investigation of barriers to instructional change. One significant barrier that has emerged is that neither faculty nor their institutions know how to evaluate student learning (or teaching effectiveness) in introductory physics courses. In this talk, we will present results from telephone interviews with 70 physics faculty related to how faculty and their institutions evaluate teaching effectiveness. We will focus on the following research questions: 1) What information is gathered about instructors? teaching and students? learning? 2) How is this information used? 3) How are different sources of information perceived or valued by faculty? Helping faculty (and possibly institutions) make judgments about whether their instruction is working may be an integral part of supporting efforts to improve undergraduate physics instruction. [Hide description](#)

# Thank You

## (Summary of Recommendations)

### Improving Dissemination

- Figure out how to provide user-friendly, convenient access to PER materials
- Customization happens – design to support it.

### More Research

- Study secondary implementations
- Develop assessments that measure things other than student conceptual understanding

### Department Culture

- Utilize change models that focus on the department level - not individual faculty
- Help departments and institutions re-think how assessment of teaching effectiveness is