

# A Framework for Categorizing Beliefs and Practice

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# Abstract

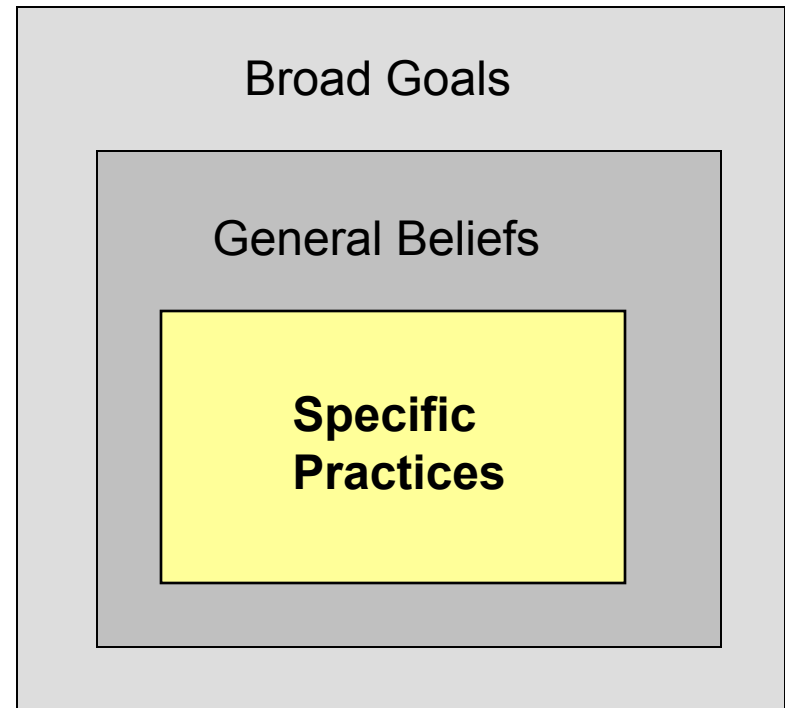
As part of an ongoing study of non-PER physics faculty, we developed a set of dimensions to categorize and analyze practices and beliefs related to physics teaching and learning. We have used these dimensions to categorize faculty as well as PER-based curricula. This tool gives us an opportunity to be self-reflective as a discipline. In this talk, we will discuss the development of the dimensions and also identify beliefs and practices that have been advocated by educational reformers in other disciplines, but are not generally found in PER-based curricula.

# Introduction

- The outcome of [physics education] research will **improve** the methodology of teaching and teaching evaluation. (*APS, 1999*)
- Why improve?
- What does it mean to improve?

# A Language of Change

- What changes are desired?
- Why?
- How can change be measured?



Outline of Talk<sup>1</sup>

# Framework for Talking about Change

- Traditional and Alternative Ideas
- Literature review
- Experimental (on-going)
  - Interviewed
    - 6 traditional faculty
    - 2 curriculum developers

# Outline of Practices

<i>Traditional</i>	<i>Alternative</i>
<b>Curriculum Centered</b>	<b>Student Centered</b>
<b>Competitive/ Individualistic</b>	<b>Cooperative Learning</b>
<b>External Motivators</b>	<b>Internal Motivators</b>
<b>Knowledge Based Content</b>	<b>Broad Based Content</b>

# Beliefs Consistent With...

## *Traditional Instruction*

## *Alternate Ideas*

### **Behaviorism**

### **Constructivism**

**Physics is quantitative.**

**Physics is also conceptual and process.**

### **School Should...**

- Select and certify.
- Maintain status quo.

### **School Should...**

- Allow all to succeed.
- Foster critical thought.

**Diversity is a nuisance.**


**Diversity is a resource.**

### **Students ...**

- Must be forced to learn.
- Are not all capable.

### **Students ...**

- Want to learn.
- Can all succeed.



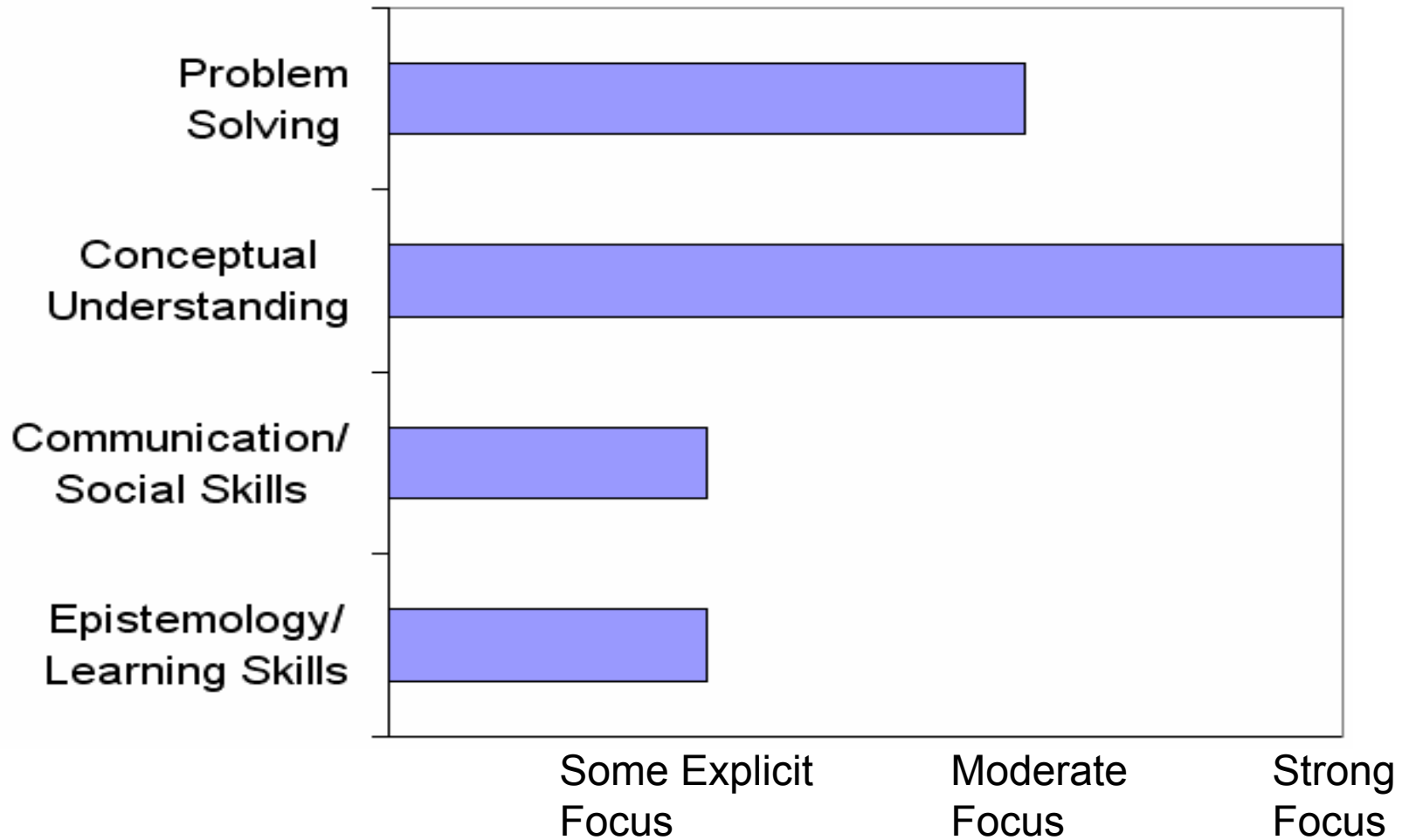
What alternative practices  
are common in PER-  
based teaching?

# Embraced Practices: Nature of Discourse

Traditional	Alternative (Interactive)
Teacher Dominates Speech	Significant Student Discourse
Mostly Teacher-Student	Student-Student Talk
<p>Focus on teacher's ideas. When students speak they...</p> <ul style="list-style-type: none"><li>• Answer rhetorical and/or closed questions.</li><li>• Ask clarification questions.</li></ul>	<p>Focus on students' ideas. When students speak they ...</p> <ul style="list-style-type: none"><li>• Ask conceptual questions.</li><li>• Answer teacher's or other students' conceptual or open-ended questions.</li><li>• Express an opinion or offer a unique perspective.</li><li>• Think aloud ... get feedback from teacher or other students on thought process.</li></ul>

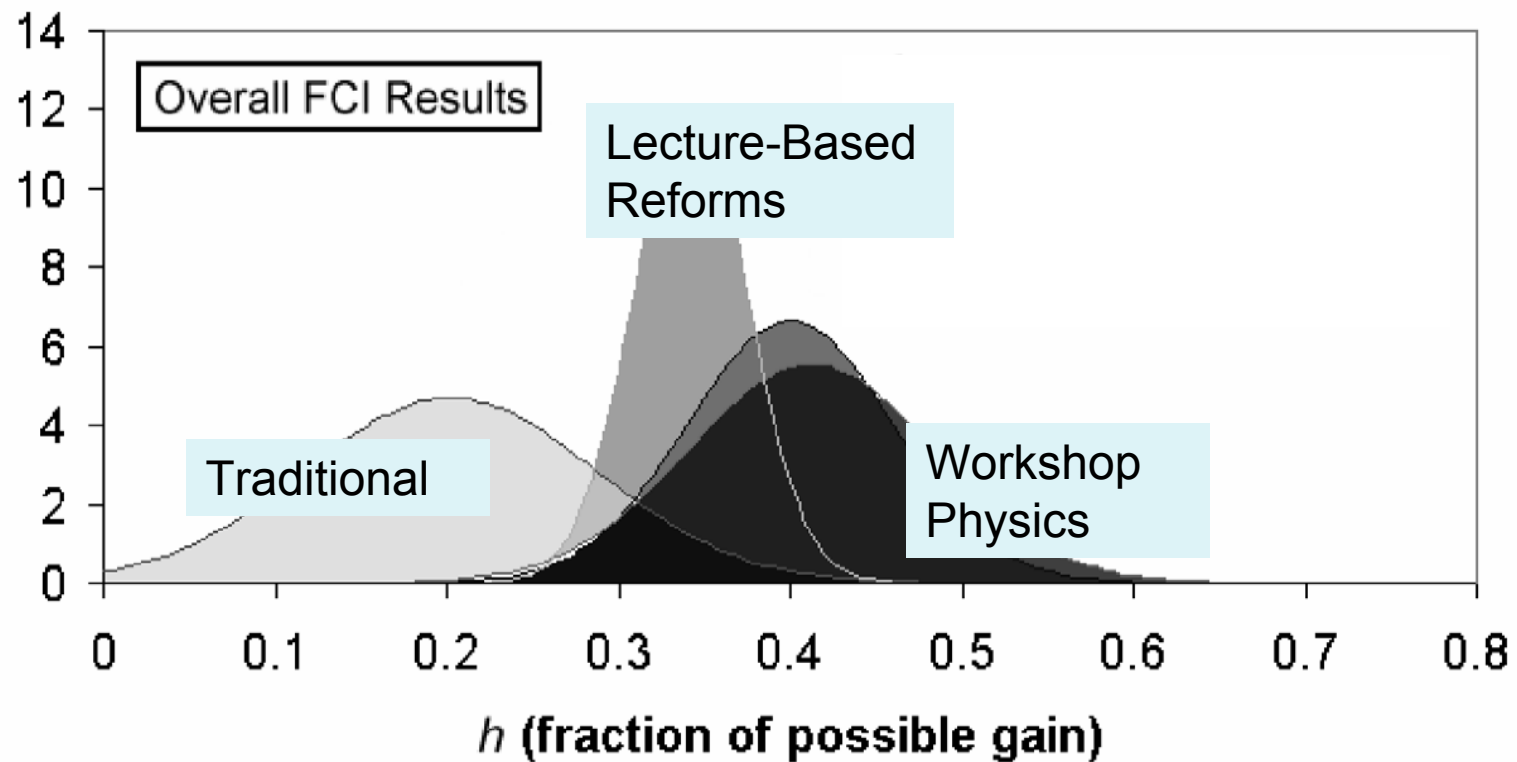
CK02 – When one instructor's interactive classroom activity is another's lecture.... Henderson ... **Next**

# Embraced Practices: Broad Content








# Big changes have most *potential* for big outcomes.

What other types of reforms might we think about?

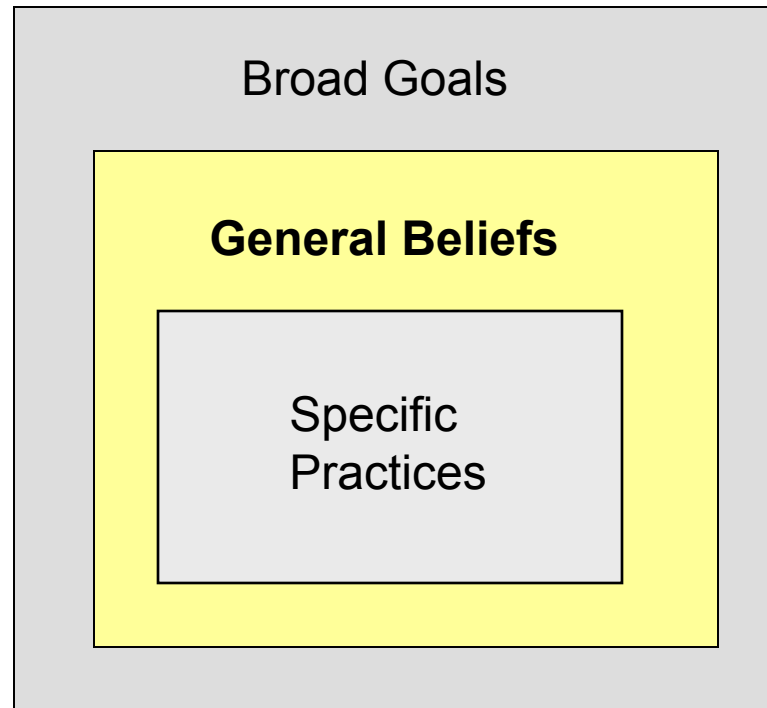


From Saul and Redish (1997). "Final Evaluation Report for FIPSE Grant #P116P50026: Evaluation of the Workshop Physics Dissemination Project," University of Maryland.

# Less embraced practices?

	<b>Teacher Control</b>	<b>Student Autonomy</b>	
<b>Content/Depth</b>			<i>Little student input.</i>
<b>Pace</b>			<i>Students work at own pace within set time.</i>
<b>Activity Structure</b>			<i>Teacher decides how class time will be used.</i>
<b>Assessment</b>			<i>Teacher decides nature of assessment.</i>
<b>What discourse is valued?</b>			<i>Generally a “correct answer”, decided by teacher.</i>

# Outline of Talk



## Teacher Control Beliefs

## Student Autonomy Beliefs

**Students can't make own decisions.**

*“Well they actually can't do it, the open-ended things completely overwhelm these students.” (Interviewee 1)*

**Modernist Knowledge Views**

Knowledge is absolute, students should learn others knowledge, teacher is the expert.

*“but the students I don't think [should] decide what they need to learn and at what pace, because one, they don't know what they need to know...” (Interviewee 2)*

**Students can make their own choices.**

**Post-Modernist Knowledge Views**

Knowledge is socially constructed and dynamic, students should develop their own knowledge.

*“I [encourage] exercises that engage the mind of the learner and extract explanation and interpretation in his or her own words.” (Arons, 1990)*

## Teacher Control Beliefs

## Student Autonomy Beliefs

**School should teach direction following and respect for authority**

**School should help students become independent, creative and critical thinkers.**

*“Students get a sense of control and responsibility [when given autonomy] that will encourage them to take more intellectual initiative in their studies and investigations in the future.” (R. Karplus, 1981)*

**Students must be forced to learn.**

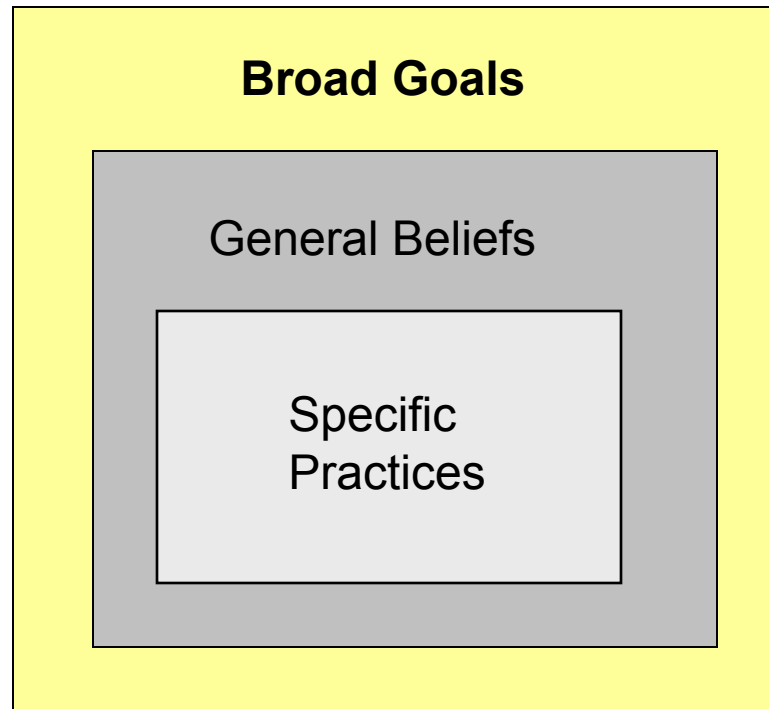
*“If you want students to learn something, you have to test them on it..” (Redish, 2003, p.75)*

*“There are some people who do things because they’re interested but most people are doing things because they need to get through this course and get a good grade.” (Interviewee 1)*

**Students want to learn.**

*“it is rare for a child to attend no lessons at all – at least, after the initial shock of freedom has worn off.” (Summerhill Free School Website)*

# Outline of Talk



# Different Goals\* ...

## **Economic**

- Prepare and sort students for workforce.

## **Democratic**

- Foster active citizens who can competently participate in a democracy.

## **Social Mobility**

- Provide opportunity for individuals to obtain desirable social positions (education is a commodity).

## **Socialization and Social Stability**

- Pass along cultural knowledge, values, norms and expectations.

# Different Changes ...

## Student autonomy through the lens of...

<b>Economic</b>	<b>Democratic</b>	<b>Social Mobility</b>	<b>Socialization</b>
<p><b>A little yes, but mostly no.</b></p> <ul style="list-style-type: none"><li>•Develop specific knowledge/skills in order to be a productive employee.</li><li>•Students must learn to accept employers goals, values, problems, methods and be externally motivated (grades, money) to work hard. . (<i>Schmidt, 2000, Mahajan, 2004</i>)</li><li>•External standards important to filter/track students for social efficiency.</li></ul>	<p><b>Essential</b></p> <p>School should help students become independent, creative and critical thinkers.</p>	<p><b>No</b></p> <ul style="list-style-type: none"><li>•Expectations must be clear and objective.</li><li>•Open-ended work can be unfair.</li></ul>	<p><b>Generally No</b></p> <ul style="list-style-type: none"><li>•Norms and values to be passed down from teacher.</li><li>•Students should learn others knowledge.</li></ul>

# Two Kinds of Change\*

- Making the current structure more efficient. (pseudo change)
  - Improve performance on standard exams.
- Changing the structure. (real change)
  - Eliminating evaluative exams.
- Most “change” is pseudo change
  - Does not challenge underlying goals, values or structure.

# Parting Thoughts...

- Framework gives language to
  - Describe extent of change.
  - Track changes over time.
  - Connect practices, beliefs and goals.
  - Envision new directions for change.
- “Improving” physics education requires more than good data.
  - Alternative ideas often contradict powerful societal goals.
  - There are many inconsistencies between beliefs and practice. (*Henderson, 2004 & Dancy, 2004*)
  - Valuable to discuss ideological differences and conflicts.

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