



## Affect not as an afterthought

coupling content and social-psychological aspects in physics learning

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Workforce / Economic Development



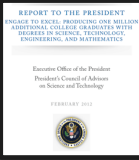
Societal Empowerment



Individual Empowerment



## A Era of Significant Attention:



The United States is now putting its future at risk by forfeiting its historical strengths in STEM education

...

Achieving scientific and technological literacy among our citizenry is a complex topic that differs in important ways from the challenge of training STEM professionals and is beyond the scope of this report; we hope that this topic will become the focus of future study.

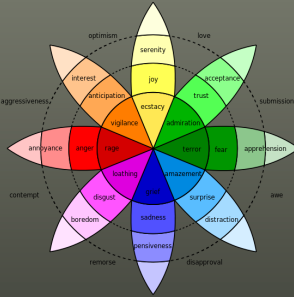
- Introduction

[http://www.whitehouse.gov/sites/default/files/microsites/ostp/peast-engage-to-excel-final\\_feb.pdf](http://www.whitehouse.gov/sites/default/files/microsites/ostp/peast-engage-to-excel-final_feb.pdf)

*affect* n |'afekt, ə'fekt|

encompassing term, used to describe the topics of emotion, feelings, and moods together, even though it is commonly used interchangeably with emotion.

- Wikipedia



wikipedia

### Affect Matters

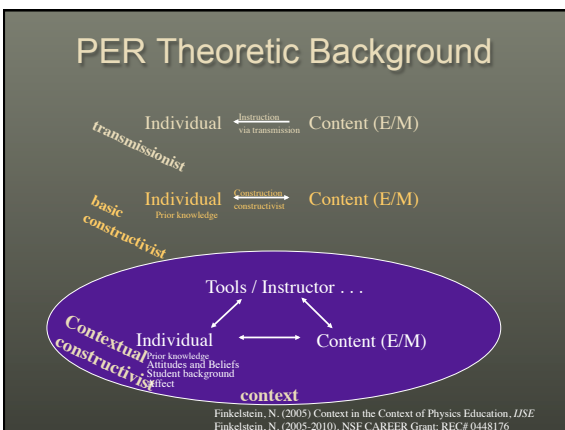
*(whether we attend to it or not)*

**Weak claim:**  
affect is means to content or "learning"

**Stronger claim**  
content is a means to the affective

**Yet stronger claim:**  
Affect, content, context, and humans are part of the intertwined social enterprise of physics education


ignore affect at our own peril




- ### Tools are key in education
- Shifting learning paradigms  
*From:* acquisition/delivery  
*To include:* enculturation
  - Tools are Defining elements of culture
  - Tools (Technologies) → essential to enculturate students

### Toy-theoretical Framework

i. tools mediate our understanding / cognitive processes



ii. context shapes the meaning / use of tools





Finkelstein (2005), adapted from Cole, M. (1996). *Cultural Psychology*

### Tools Mediate Thought

$$\frac{7960.0}{10} = \boxed{796.0} \quad \leftarrow \text{Easy!}$$

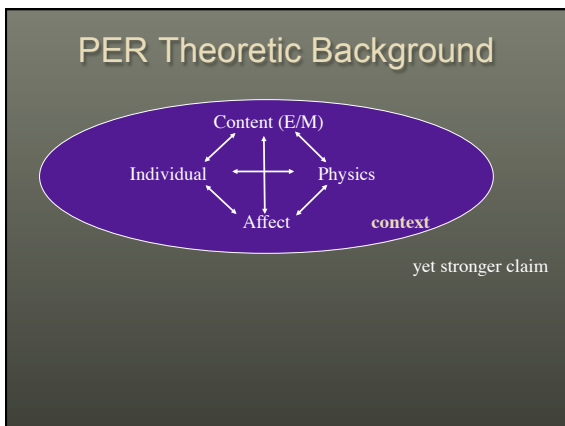
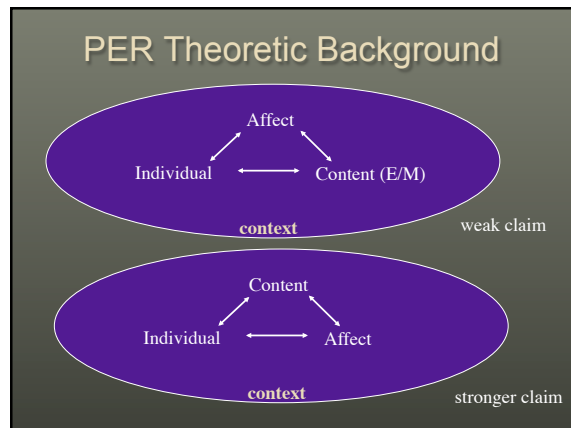
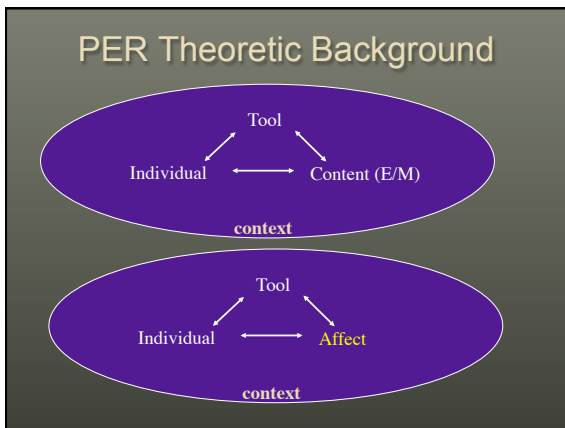
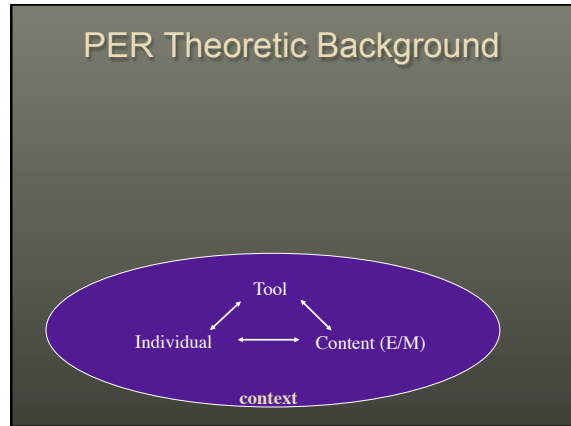
$$\frac{7960.0}{16} = \boxed{\text{Hard(er)}} \Rightarrow \frac{1F18.0}{10} = \boxed{1F1.8}$$

*Decimal (Base 10)*      *Hex (Base 16)*

### Meaning of tools

Evolutionary (biological):  
And cultural:



considering the tools,  
environments, and cultures  
we create

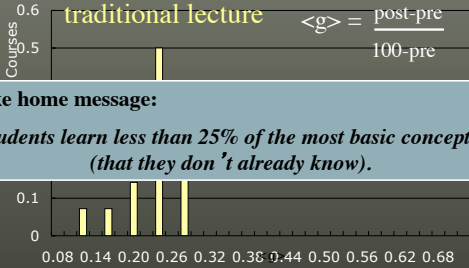
### Act as though decoupled

- Where is affect, emotion in syllabus?
- Dangers of reductionism

### Emotion built in to our classes?



### We are not teaching students

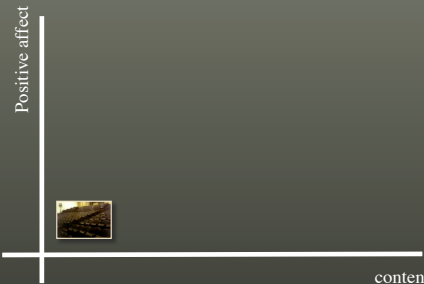


traditional lecture  $\langle g \rangle = \frac{\text{post-pre}}{100\text{-pre}}$

**Take home message:**  
*Students learn less than 25% of the most basic concepts (that they don't already know).*

R. Hake, "...A six-thousand-student survey..." AJP 66, 64-74 ('98).

### Coupling Affect / Content ?




**...John Dewey Says:**

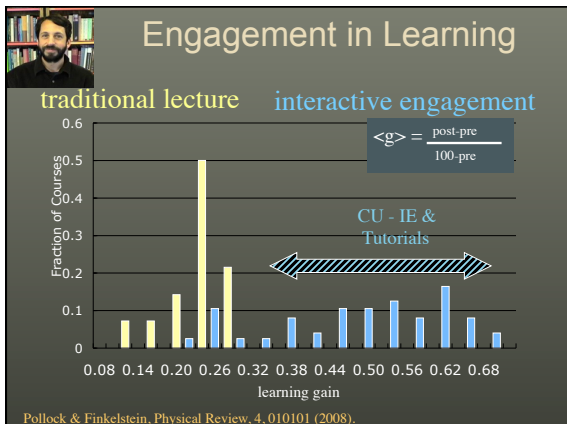
"We never educate directly, but indirectly by means of the environment. Whether we permit chance environments to do the work, or whether we design environments for the purpose makes a great difference."  
 (Democracy and Education, 1916)

**We need to be intentional about how we design environments.**

From Noah Podolefsky

### Courses Transformed & Interactive Engagement

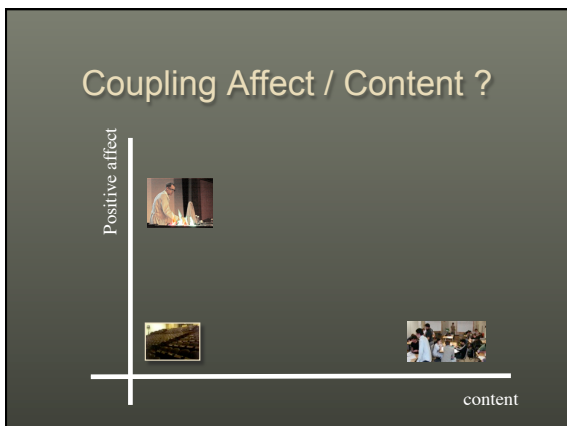
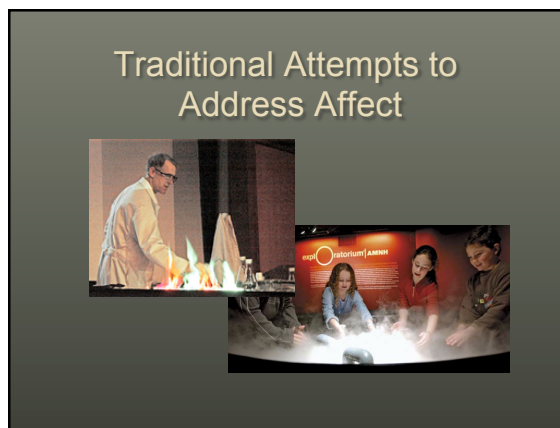
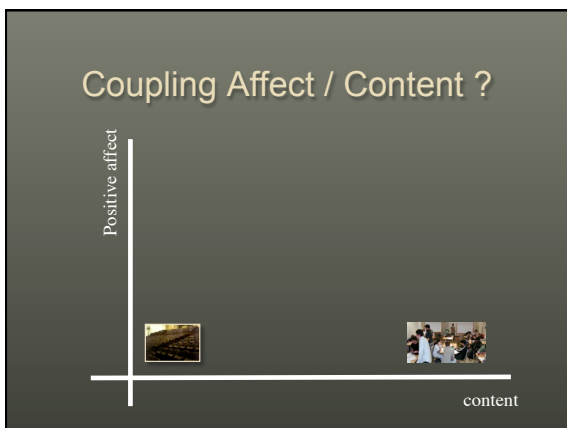




### CLASS categories

Shift (%) ("transformed" class)

Real world connect...	-6
Personal interest.....	-8
Sense making/effort...	-12
Conceptual.....	-11
Math understanding...	-10
Problem Solving.....	-7
Confidence.....	-17
Nature of science.....	+5
(All ±2%)	



becoming more intentional  
designing tools / spaces/ practices...  
culture

Designing a new space,  
practices and culture

Hinko, PISEC, 2012

### University-Community Partnerships

CU University Educators ↔ Community Centers (e.g. H.U.D.)

Stop Action Motion      PISEC – Jr. Scientists' League      PhET: computer sims

Hinko, 2012, 2013...

### PISEC

grounded in the affective

Impacting Student's

- Content
- Communication
- Identity

### New Tools, Traditional School

VanDusen, Belleau, Otero

### New Tools, Traditional School

Student Peer Cultural Practices	Physics Classroom Cultural Practices
Messaging	Assignment submission
Picture and video sharing	Lab Reports
Social media	Problem Solving
<b>iPad</b>	
Authentic Physics Cultural Practices	
Data collection	Data sharing
	Peer review

VanDusen, Belleau, Otero

### PhET Sims... building in affect

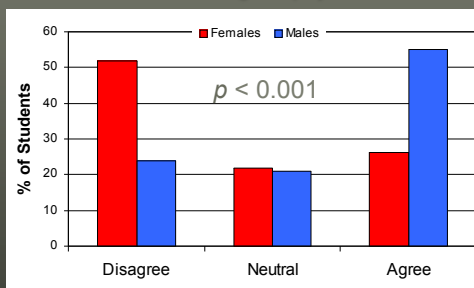
Podolefsky, Perkins, & Phet Team

## New Practices, Traditional University

Kost, Stout, Ito, Cohen, Miyake, Pollock, Finkelstein

## Physics Identity

- I feel like I could be a good physicist.



## Sense of Physics Identity

Jane G. Stout,<sup>1</sup> Tiffany A. Ito,<sup>1</sup> Lauren E. Kost-Smith,<sup>2</sup> Geoff L. Cohen,<sup>3</sup> Noah D. Finkelstein,<sup>1</sup> Akira Miyake,<sup>1</sup> & Steven J. Pollock<sup>1</sup>

<sup>1</sup>University of Colorado Boulder <sup>2</sup>Northwestern University <sup>3</sup>Stanford University

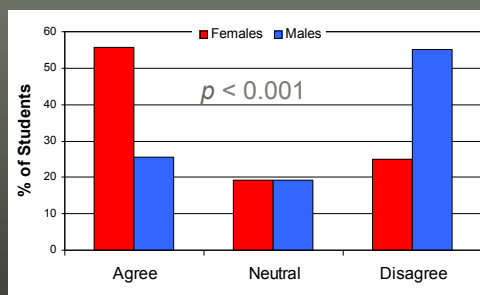
“The way a person understands and views himself, and is viewed by others”<sup>1</sup>

“who they think they are ... and who they want to be.”<sup>2</sup>

<sup>1</sup>J. Lave & E. Wenger, *Situated Learning*, 1991.  
<sup>2</sup>N.W. Brickhouse, et al. *J. Res. Sci. Teach.* **37**, 441 (2000).

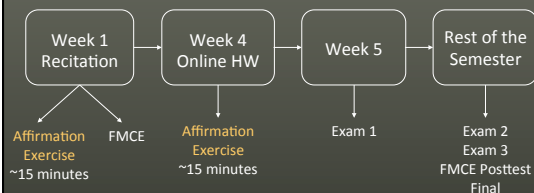
## Physics Self-Efficacy

- Physics makes me feel uneasy.

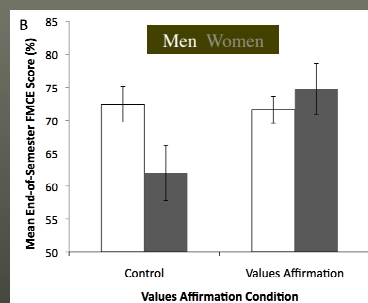


## Experimental Design

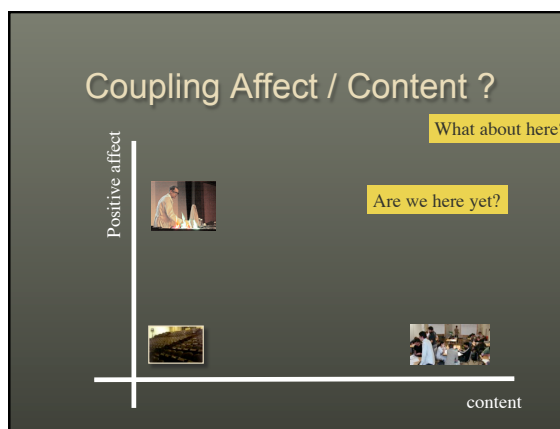
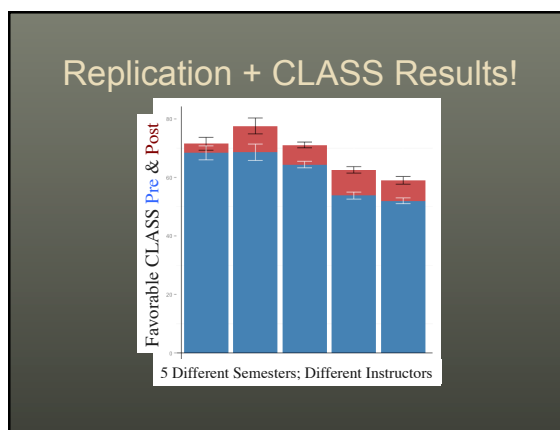
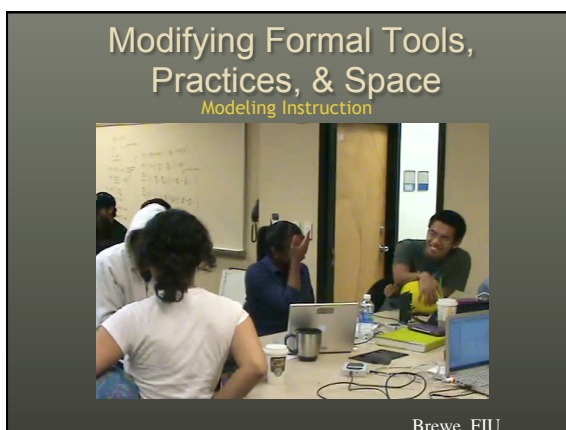
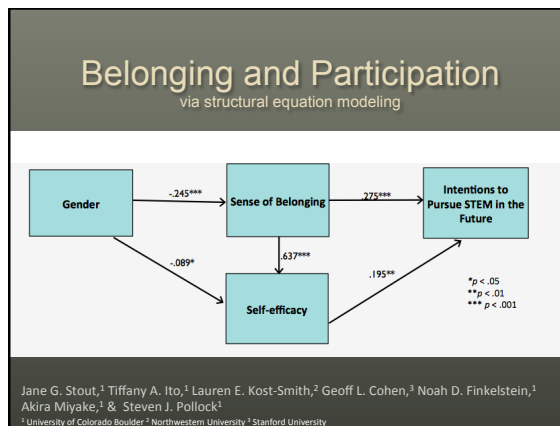
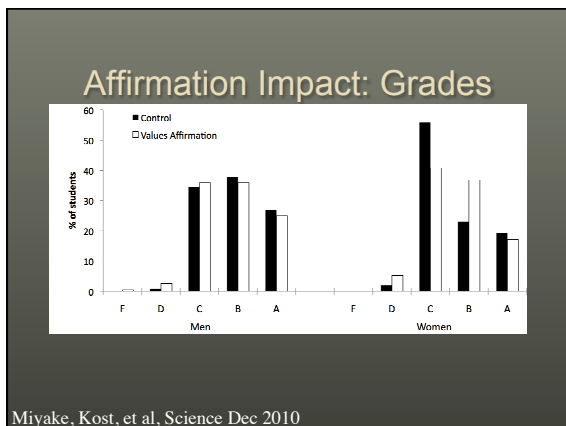
- 2 X 2 randomized design:
  - gender (M,F) X condition (affirmation, control)
- Administer affirmation exercise 2 times



## Affirmation Impact



Miyake, Kost, et al. *Science* Dec 2010





Blurring the lines further  
Informal Gateways for UEs  
(a matter of institutional structures)

## PISEC Science Spectacular

### Observations

- UE's took charge
- Overwhelmed by the huge, positive audience feedback
- "It was probably one of the best experiences of my life."



Dewey Warned  
Avoiding dysfunction of *Either-Or*

### Understand continua and inter-relations

- Medium & Message  
(Structures, Tools, Context, & Content)
- Learners & Teachers
- Formal & Informal
- Play & Learning
- Affect & Content

What we might do. . .

- These are our classrooms
- We already enact such approaches . . .
- Time for scholarship / education of affect
- Historically difficult & marginalized

Let's be heard . . .

- It's time to proudly announce ourselves
- We are the ones to make a difference.
- If you need a reminder, take a souvenir.

*fin*

<http://per.colorado.edu>  
or  
<http://spot.colorado.edu/~finkelsn>