Concept Warehouse: Bring-a-Friend

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Acknowledgements

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- LL Stewart Scholar Program
- Technology Resource Program

*Any opinions, findings, and conclusions or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

AIChE Concept Warehouse

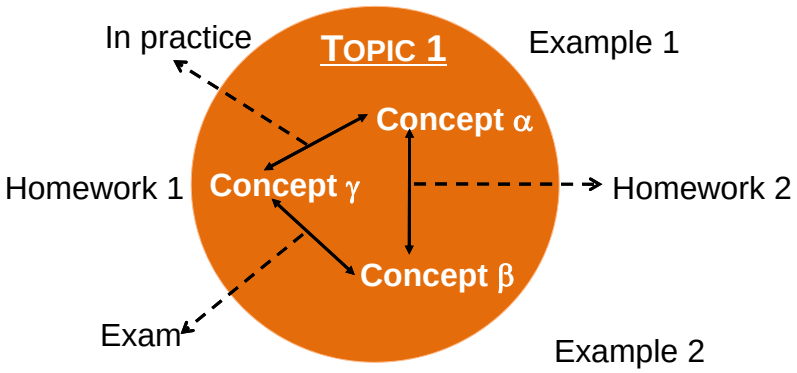
Cyber-enabled infrastructure for conceptual questions

- Create a community of Learning within the discipline of chemical engineering focused on concept-based instruction
- Lower the activation barrier to promote implementation of concept-based instruction and active learning

Problem Solving: Procedural Approach

Example	Homework	Exam
Given *T*	Given *T*	Given *P*
Step 1	Step 1	Step 4
Step 2	Step 2	Step 3
Step 3	Step 3	Step 2
Step 4	Step 4	Step 1
Find *P*	Find *P*	Find *T*

Problem Solving: Conceptual Approach



Integrated Conceptual Knowledge Structure

Objective: To develop conceptual understanding by removing the "calculation procedure" from the question

Interactive Exploration

1. Enter your email at:

http://tinyurl.com/prsbo5g

2. Website login:

http://cw.edudiv.org

http://jimi.cbee.oregonstate.edu/concept_warehouse/bill_test/emails.php?admin=1

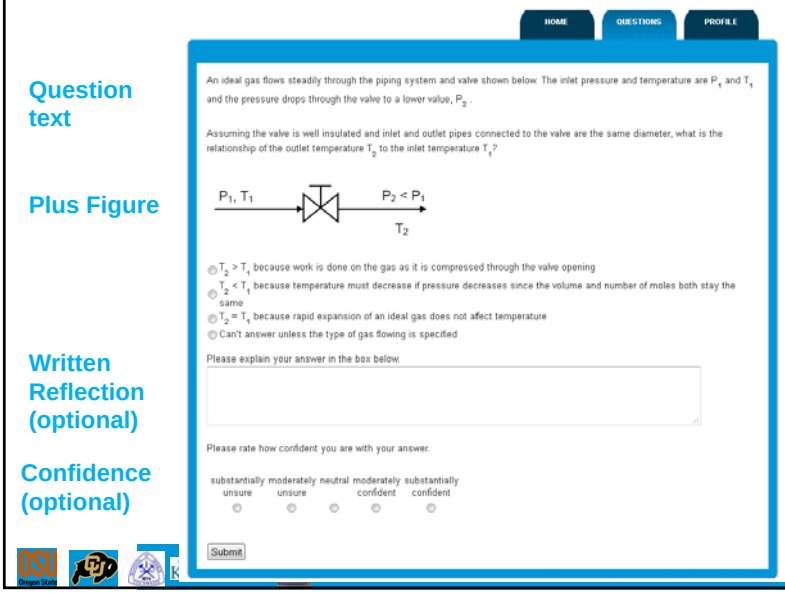
Example Question:
What students see when you assign online

Question text

Plus Figure

Written Reflection (optional)

Confidence (optional)



Multiple Choice Answer Selections

Peer Instruction

- The process we just went through was popularized by Eric Mazur and is called Peer Instruction (PI)
- With your group, Draw a “flowsheet” of the steps in delivering PI

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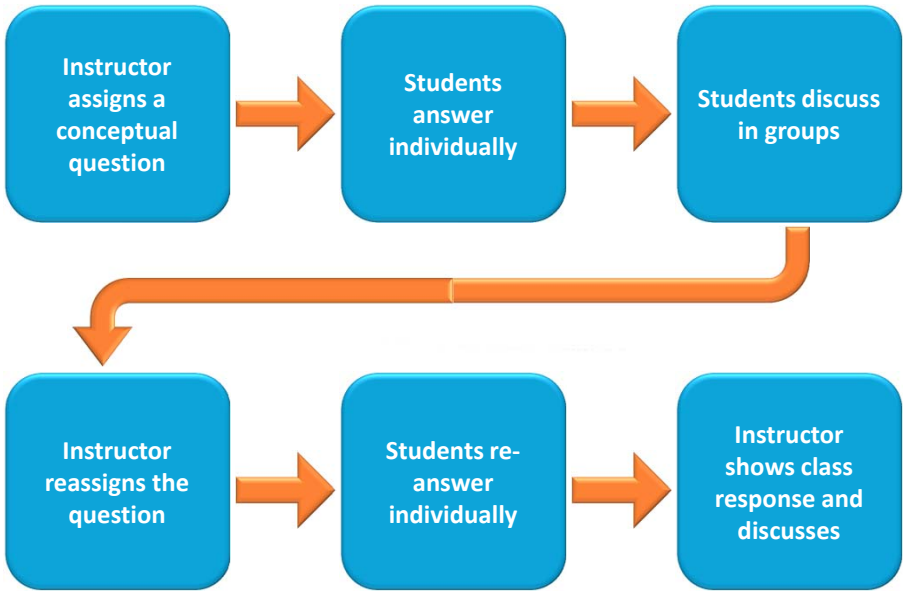
Peer Instruction



Traditional Lecture vs. Peer Instruction Using the AIChE Concept Warehouse

http://www.youtube.com/watch?v=N1KxrTqIu2U

AIChE Annual Conference
November 5th, 2013

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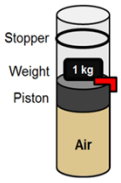
Expanding Piston

Air at high pressure and ambient temperature is contained in a perfectly insulated piston-cylinder device. If the locks holding the piston in place are removed, the piston moves upwards to a stopper. The temperature of the air _____.



- increases
- remains the same
- decreases

Please explain your answer in the box below.

Balloon Rising

A perfectly insulated balloon filled with an ideal gas rises into the sky. As the balloon rises, the external pressure decreases, causing the balloon to expand. What happens to the temperature of the gas inside the balloon?

- increases
- decreases
- remains the same
- need more information

Please explain your answer in the box below.

Submit

Isomorphic questions: same core concept, but with different "cover stories"

Expanding Piston

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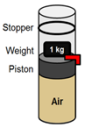

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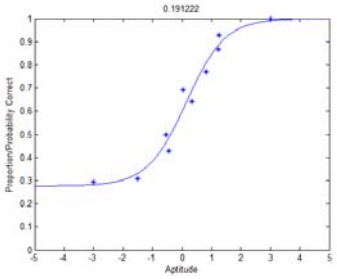
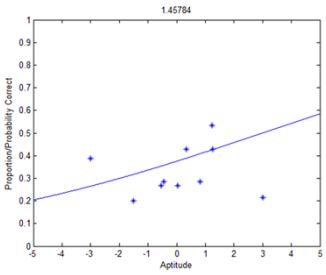
Example of Item Response Theory for Question Quality

Good Question



Poor Question



$$P_i(\theta) = c_i + \frac{1 - c_i}{1 + \exp[-1.7a_i(\theta - b_i)]}$$

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Modes of Use

Online

- Homework
- In-class:
  - Cell Phone
  - Laptop
  - Turning Point Clickers



Offline

- Download questions (and answers) in Microsoft PowerPoint or Word
  - Homework
  - Test
  - External clicker system


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Users Summary

No. of Institutions	No. of Faculty Accounts	No. of Students	Questions Used		Electronic Answers Submitted
			Online	Downloaded	
135	344	4,799	2,950	2,287	Around 150,000

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Current Users

- How do you use the CW?
- Please share some of your experiences
- Anything you want to try in the future?

ConcepTests

ConcepTests

ConcepTests are questions selected or written by the instructor

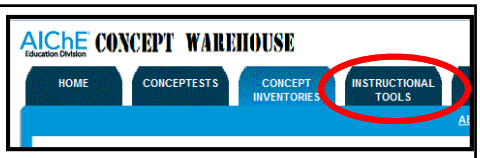
- Typically used in class (like we just did).
- Helps the students develop understanding of engineering concepts.
- Helps faculty and students identify level of mastery.
- Should be used in a “low stakes” environment.
- Effective in large classes to promote greater engagement.

Concept Inventories

Concept Inventories (CIs) are "valid and reliable instruments" i.e., pre-assembled tests meant to help instructors determine the extent of conceptual understanding about specific science or engineering subjects.

- Usually used at the start and end of a class to measure the "learning gains" and compare different instructional designs.

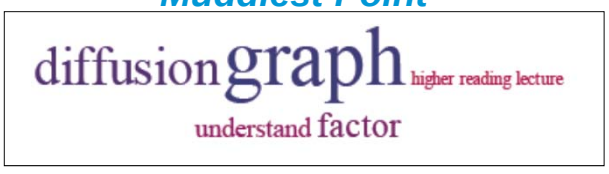
Reflection Word Clouds (Krause, ASU):



Diffusion in Metals

Most Interesting Point

Muddiest Point



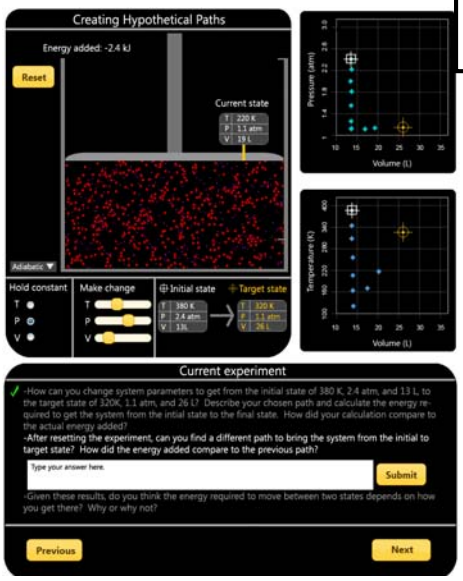
Reflections on Processing of Metals I: Diffusion

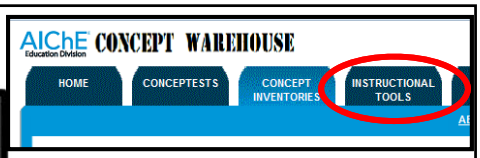
• Points of Interest (3.3):

- **"Finding out that the LEDs in traffic lights going out is due to diffusion."**
- **"I liked application of what we learned on BCC & FCC coming back to use"**
- **"Learned what mechanisms atoms use to move."**
- **"The review chart for failure types from the last lecture muddiest points."**
- **"I had also never thought of atoms in solids actually moving spaces, I had just pictured them oscillating."**

• Muddiest Points (3.1):

- "What is bulk diffusion and what causes it?"
- "What higher and lower slopes on the ln D v. 1/T graphs actually mean in terms of the material."
- "I think reading some of the graphs and determining which equations to use was a little difficult."
- "Photos in lecture notes and from projector hard to see and understand."
- "Finding higher and lower Q"





Interactive Virtual Laboratories

Assessment Survey

Collaborators

Student Researchers
- Debra Gilbuena, PostDoc
- Bill Brooks, PhD
- Christina Smith, PhD
- Kritsa Chinandon, PhD
- Rachel White, BS
- Daniel Reid, BS
- Matt Boggess, BS
- Alec Bowen, HBS
- Cole Morgan, BS
- Matt Kirsch, BS

Faculty
- Adam Higgins, Oregon State University
- Steve Krause, Arizona State University
- Mike Prince, Bucknell University
- Margot Vigeant, Bucknell University

- Beta Testers
- The developing community who has contributed to and used the Concept Warehouse

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http://cw.edudiv.org