

Evaluating Students' Uses of Screencasts

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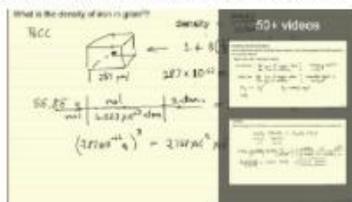
October 16, 2014

What is a screencast?

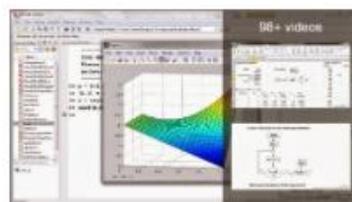
- Short videos (<10 min) with narration made using digital capture technology.
- Focus on a single topic, simulation, or sample problem.
- Peer-reviewed.
- Can be used to supplement classroom instruction or as a study aid.

Screencasts

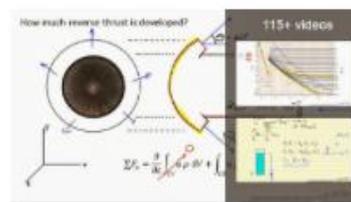
Screencasts are short screen captures, usually of a tablet PC, with instructor narration. They supplement textbooks and lectures by featuring solutions to example problems, explanations of concepts, software tutorials, descriptions of diagrams, and material reviews. They are made and reviewed by faculty. (CC) indicates the entire playlist has closed captioning. Screencasts are available for the following engineering courses/topics:



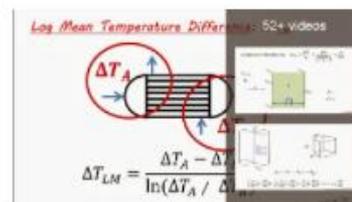
[Chemistry](#)



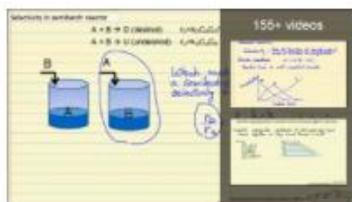
[Engineering Computing](#)



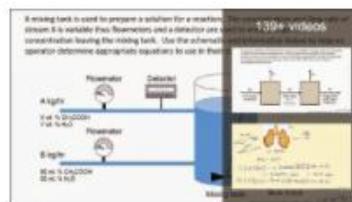
[Fluid Mechanics \(CC\)](#)



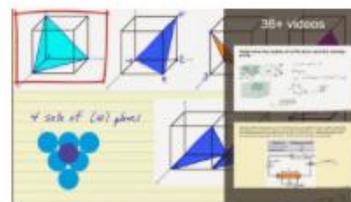
[Heat Transfer](#)



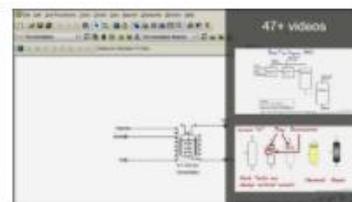
[Kinetics/Reactor Design](#)



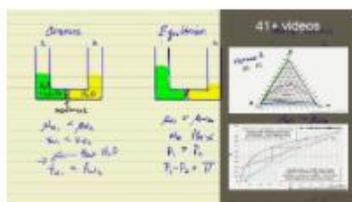
[Material and Energy Balances \(CC\)](#)



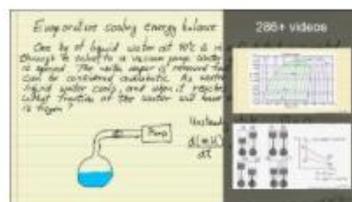
[Materials Science \(CC\)](#)



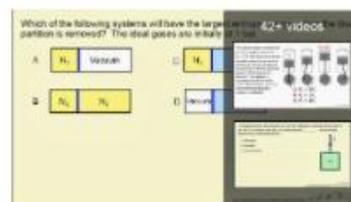
[Process Design](#)



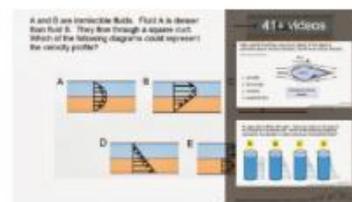
[Separations/Mass Transfer](#)



[Thermodynamics](#)



[Interactive Thermodynamics](#)



[Interactive Fluids](#)

Screencasts

- 1,100 Titles
 - In chemistry, fluid mechanics, heat transfer, kinetics, mass and energy balance, and more.
 - Introductory, problems, tutorials, conceptual questions, interactive, and reviews.
- 4.9 million views (YouTube and iTunesU).
- 2.1 million downloads in 12 months.
- 135 countries.

LearnChemE Project Goals

- Ensure comprehensive coverage of chemical engineering topics, including increased coverage for basic topics.
- Evaluate effectiveness of screencasts.
- Understand faculty/student usage to improve screencasts.
- Expand usage through faculty support and increasing ease of use for students.

Purpose of our Study

- Identify aspects of screencasts that help students learn, and barriers that impede learning.
- Collect information for improving the screencasts.

Method

7 students
volunteered.

Participants were
asked to watch 2
screencasts each.

They answered
questions about their
experience and made
suggestions to
improve usability.

Conducted using
Silverback on a
MacBook Pro laptop.

Subjects
9 students
MEB - 5
KINETICS - 4

9 videos
3 Intro
3 Example
3 Interactive

Student 1
MEB
Intro A

Student 2
KINETICS
Intro B

Student 3
MEB
Intro C

Student 4
MEB
Example A

Student 5
KINETICS
Example B

Student 6
KINETICS
Example C

Student 7
MEB
Interactive A

Student 8
KINETICS
Interactive B

Student 9
MEB
Interactive C

Practice Run
3 people
- Intro
- Example
- Interactive

LOCATION - RM 203
FCC
OR CORY'S
OFFICE
ECLR 228

NAVIGATION
- FOLLOW TASK
- CUED RECALL
- POINTS OF HESITATION
- RECORD THINKING / CHALLENGE

ENGAGEMENT
- FOLLOW TASK
- CUED RECALL
- POINTS OF HESITATION OR DISTRACTION
- RECORD THEIR CHALLENGE OR DISTRACTION
- DESCRIBE INDICATORS OF ENGAGEMENT
- SPEED
- INQUIRIES?

PROBLEM-SOLVING
- FOLLOW TASK
- ASK THEM TO SOLVE A PROBLEM
- NOTE WHETHER OTHER MATERIALS ARE USED
- THEY ASK FOR HELP
- CUED RECALL
- DO PANSSES INDICATE CONFUSION, PONDERING, REPRANING?

LEARNING PREFERENCES
- FOLLOW TASK
- ASK THEM TO DESCRIBE HOW THEY WOULD PREFER TO USE THEM IN STUDYING / LEARNING
+ HOW HAVE THEY USED THEM?

Findings

Presentation—Content

- Include a clear problem statement at the beginning.
- Include links to other similar screencasts.
- Divide longer screencasts into chapters for easier navigation.

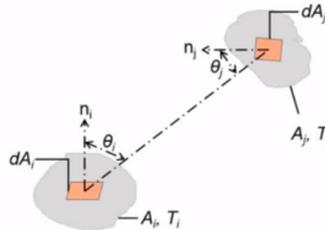
Presentation—YouTube

- Include a brief description of the content of a screencast in the video description on YouTube
- Put similar screencasts in a YouTube playlist.

Pacing—Narration

Narration should be fast enough at the beginning to capture attention.

View factor (F_{ij}): fraction of the radiation leaving surface i that is intercepted by surface j

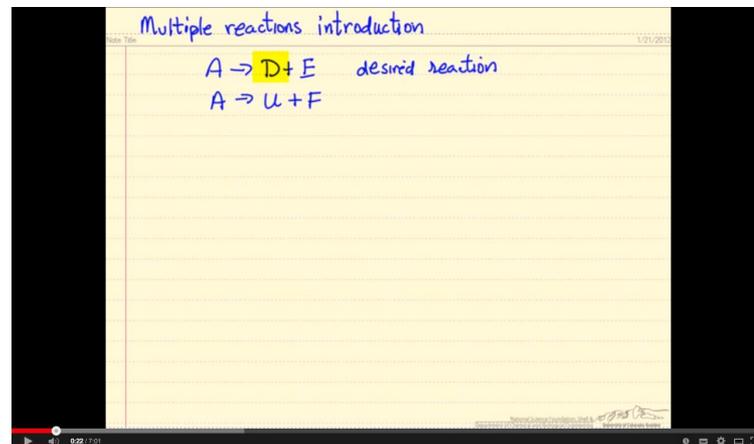


<http://www.youtube.com/watch?v=UifRBB49MC4&list=PL242066E80621CC10&feature=share&index=59>

Pacing—Narration

...and yet, narration should also be slow enough so that when explaining concepts, or solving problems, students can comprehend what is being presented.

<https://www.youtube.com/watch?v=2ugTnETtlyM>

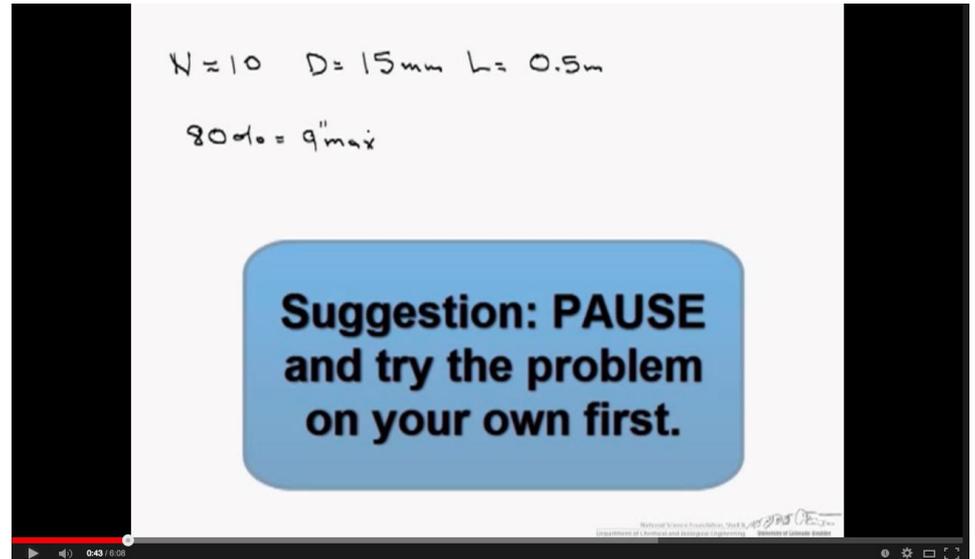


The screenshot shows a video player with a yellow notepad background. The text on the notepad is handwritten in blue ink. At the top, it says "Multiple reactions introduction". Below that, there are two chemical reactions: $A \rightarrow D + E$ and $A \rightarrow U + F$. The letter 'D' in the first reaction is highlighted in yellow. To the right of the first reaction, the words "desired reaction" are written in blue ink. The video player interface at the bottom shows a progress bar at 0:22 / 7:01 and various control icons.

Pacing—Narration

Students should be encouraged to pause, and take notes if needed.

<http://youtu.be/mGzreZwoaJ0?t=40s>



$N = 10$ $D = 15 \text{ mm}$ $L = 0.5 \text{ m}$

$80 d_0 = q''_{\text{max}}$

**Suggestion: PAUSE
and try the problem
on your own first.**

0:43 / 6:08

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Pacing—Pauses

When including formative assessment questions, include adequate time for students to select a response to a question.

Two tanks are filled with air and connected by water-filled manometers. Based on the figure below, what is the gage pressure in Tank 1?

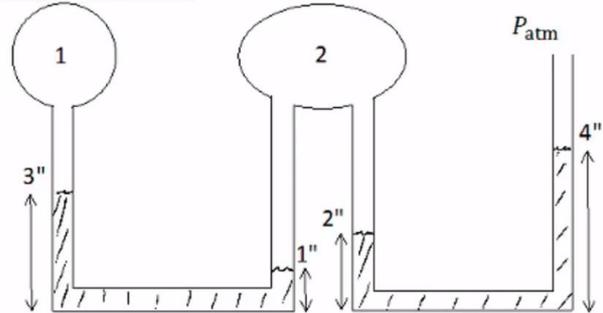
Choose the correct answer.

A. 3" H₂O

B. 1" H₂O

C. 0" H₂O

D. -1" H₂O



Presentation—Writing

Writing should be legible, and mistakes should be corrected before publishing.



Handwritten equation: $h \cdot g = 2257 \text{ kg}^2/\text{kg} \rightarrow 2$

National Science Foundation, Grant # 1122000
Department of Chemical and Biological Engineering
University of Colorado Boulder

Full screen

2:48 / 6:08

<http://youtu.be/mGzreZwoaJ0?t=2m36s>

Presentation—Scrolling

Keep long text spans from scrolling off of the screen.

$$S_{el} = \frac{\text{rate of formation of D}}{\text{rate of formation of all products}} = \frac{N_D}{N_D + N_U}$$

Concentration, temperature, catalyst, reactor type
Conversion

1) Higher reactant concentration favors higher order reaction

$A \rightarrow D \quad r_D = k_1 C_A^2$
 $A \rightarrow U + R \quad r_U = k_2 C_A$

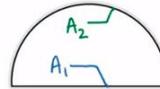
National Science Foundation, Shell & Amoco, University of Illinois at Urbana-Champaign

Presentation—Highlighting

- Highlighting should appear before it is orally introduced.
- Use permanent highlighting instead of temporary highlighting.

View factor (F_{ij}): fraction of the radiation leaving surface i that is intercepted by surface j

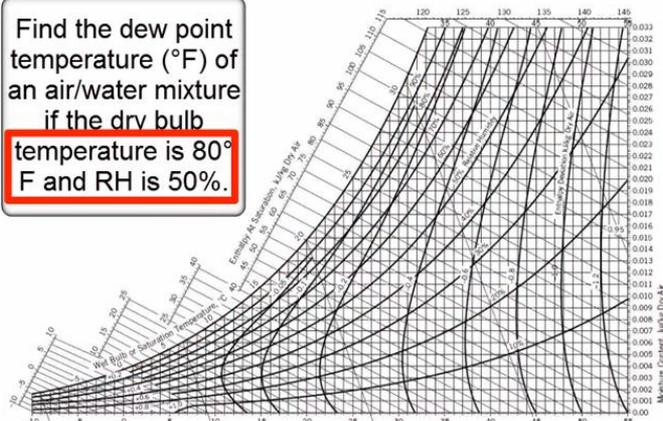
1. inspection
2. reciprocity: $A_i F_{ij} = A_j F_{ji}$
3. summation: $\sum F_{ij} = 1$



Presentation—Consistency

Units and labeling should be consistent throughout a screencast.

Find the dew point temperature ($^{\circ}\text{F}$) of an air/water mixture if the dry bulb temperature is 80°F and RH is 50%.



problem. Find the dew point of the air water system of the dry bulb temperature is 80 degrees

Figure 84-1 Psychrometric chart—SI units. Reference states: H_2O (L, 0°C), 1 atm. (Copyright 2003, McGraw-Hill Education, Inc.)

A tank contains 10 kg of saturated air. The dry bulb temperature is 20°C . Find the enthalpy of this system in kJ.

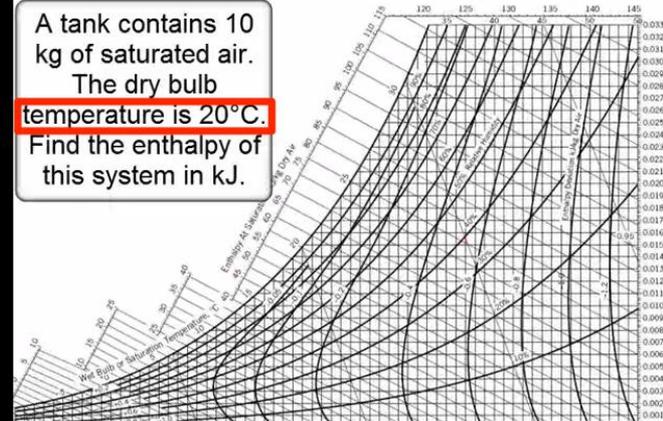


Figure 84-1 Psychrometric chart—SI units. Reference states: H_2O (L, 0°C), 1 atm. (Copyright 2003, McGraw-Hill Education, Inc.)

Audio Quality

Ensure audio quality is good (no scratches or hums).

Handwritten mathematical derivations for audio quality parameters:

$$\begin{aligned} \mu_e &= 279 \times 10^{-4} \text{ N}\cdot\text{s}/\text{m}^2 & P_{r2} &= 1.76 \\ h_{fg} &= 2257 \text{ kJ}/\text{kg} \rightarrow 2257 \times 10^3 \frac{\text{J}}{\text{kg}} \\ \sigma &= 58.9 \times 10^{-3} \text{ N}/\text{m} & \rho_v &= 0.5955 \text{ kg}/\text{m}^3 \\ q''_{\max} &= 0.149 h_{fg} \rho_v \left[\frac{\sigma g (\rho_l - \rho_v)}{\rho_v^2} \right]^{1/4} \\ &= 1.26 \times 10^6 \text{ W}/\text{m}^2 \\ q''_s &= 1.008 \times 10^6 \text{ W}/\text{m}^2 & m &= 0.105 \frac{\text{kg}}{\text{s}} \\ \Delta T_s &= \frac{C_{p,l} h_{fg} P_{r2} h}{C_{p,l}} \left(\frac{q''_s}{\mu_e h_{fg}} \right)^{1/3} \left(\frac{\sigma}{g L P_{r2}} \right) \end{aligned}$$

Video player controls: 5:10 / 6:08, Full screen

<http://youtu.be/mGzreZwoaJ0?t=4m6s>

<https://www.youtube.com/watch?v=mGzreZwoaJ0>

Next Steps

- Findings used to inform revisions to current screencasts and development of new screencasts.
- Second round of usability studies to examine these findings in greater depth.
- Ongoing data collection to tie screencast characteristics to student use and understanding.

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Special thanks to Cuining Liu for website design support

Natanya Cooper, Massiel Puentes, Joel Bozekowski, Gregory Russi, Xiao Ba, Isabella Funke, Zachary Gibbs, Michael Holmberg, Cuining Liu, Audrey Schaiberger

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