

Flipped Classroom: the ideal teaching method in the time of pandemics - or any time

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Background

USA 1986 – 2006

Assoc./Professor KU 2006 - now

Computational Chemist

Lectured 1996 - 2011



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The flipped classroom / active learning

Before class: acquire knowledge

Read or watch videos

Take a quiz

In class: answer questions/use knowledge

Peer instruction

Question => Discuss => vote

> 75% correct => proceed

> 40% correct => Discuss => re-vote

< 40% correct => Lecture



Lesson Plan

⋮	▼ Uge 4	✓	+	⋮
⋮	 uge 4 videoer 0 point	✓		⋮
⋮	 slides til mandagsvideoerne	✓		⋮
⋮	 uge 4 svar før mandag 20. sep 2020 5 point	✓		⋮
⋮	 slides fra mandags forelæsningstimer	✓		⋮
⋮	 slides til onsdagsvideoerne	✓		⋮
⋮	 uge 4 svar før onsdag 22. sep 2020 6 point	✓		⋮
⋮	 Slides fra onsdags forelæsningstimer	✓		⋮
⋮	 ugeseddel 4.pdf	✓		⋮
⋮	 Supplerende læsning uge 4	✓		⋮



You don't need to lecture if students do the reading

"Reading" Quizzes – *before* "lecture" quizzes

Absalon – KUs course software



Svar før mandag

Spørgsmål til videoer samt slides

5.1: [Fri energibidrag for en ideal opløsning](#) (5:35 min)

5.2: [Solveringsfrienergi: det polære bidrag](#) (6:25 min)

5.3: [Solvent "screening"](#) (4:39 min)

5.4: [Den ikke-polære solvationsenergi](#) (4:58 min)

5.5: [Den hydrofobe effekt](#) (4:01 min)

[Slides in mandagsvideoer](#)

Fortsæt ➤



Could also be assigned reading

Resultater

Forsøg nr.	Besvaret	Point	Detaljer
1	Du påbegyndte det 1. forsøg på denne test den 14. februar 2014 13:25		1 / 6 svar

Testoplysninger



Deadline: **14. februar 2014 23:59**

Tilladte forsøg: Ubegrænset

Tidsgrænse: Nej

Hvilket forsøg tæller: Bedste forsøg

Obligatorisk: Ja

Bedømmelse: Nej

Antal spørgsmål: 6



Quiz



Svar før onsdag

1 2 3 4 5 6

Spørgsmål 1

Hvad er en endoterm reaktion?

Dit svar:

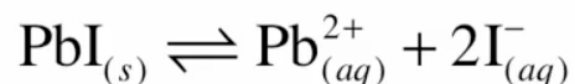
- ☒ enthalpien stiger
- ☐ enthalpien falder
- ☐ enthalpien er uændret

Næste →

⏏ Afbryd test



Video lecture instead of/in addition to reading or lecture



$$K = [\text{Pb}^{2+}][\text{I}^{-}]^2 \quad K = e^{-\Delta G^{\circ}/RT}$$

$$\Delta G^{\circ} = 46.1 \text{ kJ/mol} \Rightarrow K = 5.93 \times 10^{-9} \quad 20^{\circ}\text{C}$$

$$\Rightarrow [\text{Pb}^{2+}] = 1.14 \times 10^{-3} \text{ M}$$

$$\text{målt: } [\text{Pb}^{2+}] = 1.37 \times 10^{-3} \text{ M}$$

Mere Pb^{2+} opløst end forventet!

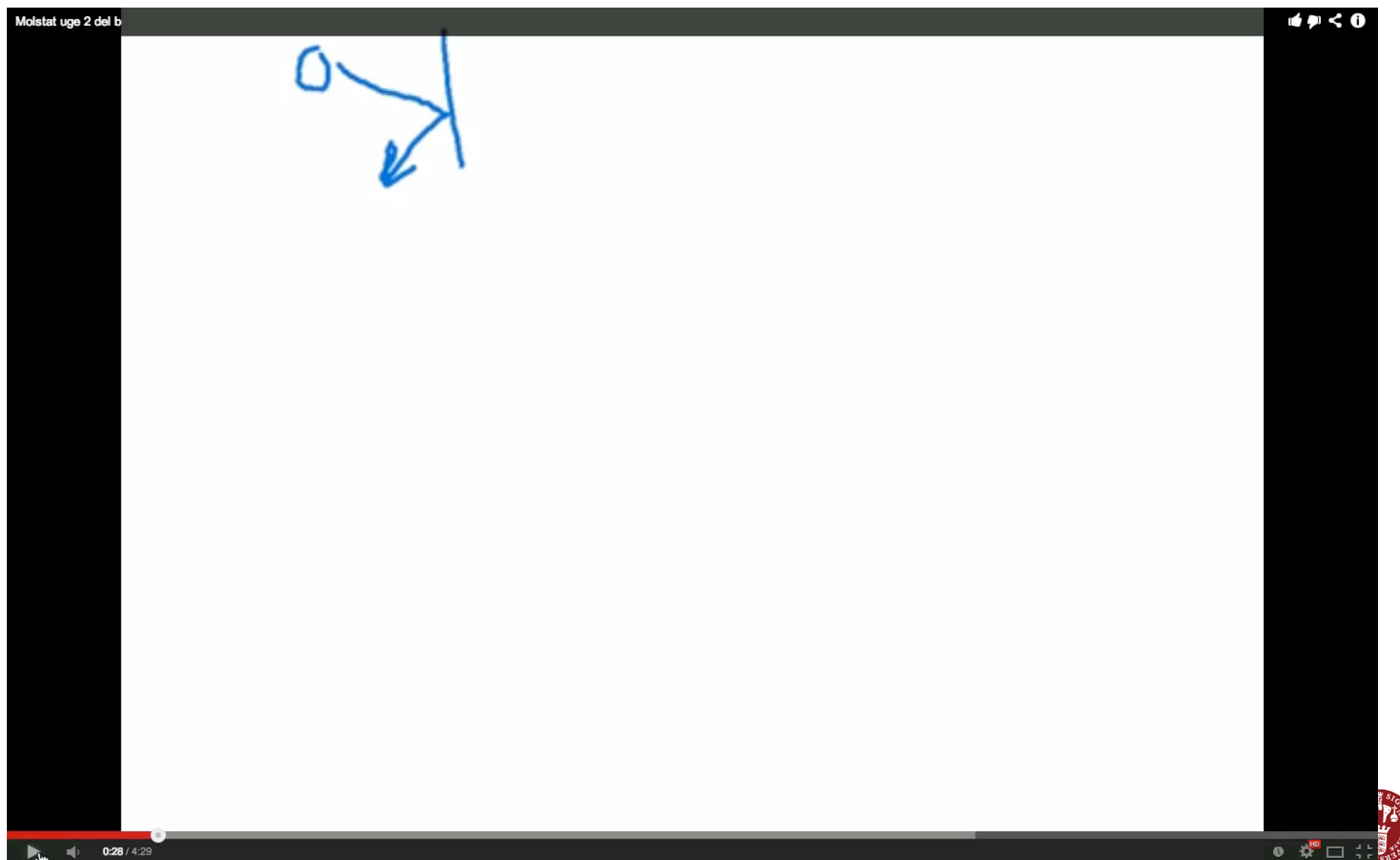
<http://youtu.be/Va5LJ8UX7sY>

Tools: PPT + **Screenflow** (Mac) or **Camtasia** (PC) + head phones



Pen-casting

Tools: iPad + **Explain Everything** App + Stylus



<http://youtu.be/0qYzSq5Lefw>

Advantages of *Good* Video Lectures

Watch any time

Pause / Repeat

Manageable (max 7 minutes)

Contain questions

Can include animation/video

No “getting behind”

Faster to make than detailed lecture notes

(Can also be used for detailed solutions to homework)

Freedom from textbook

If you like your textbook, fine but most textbooks ...

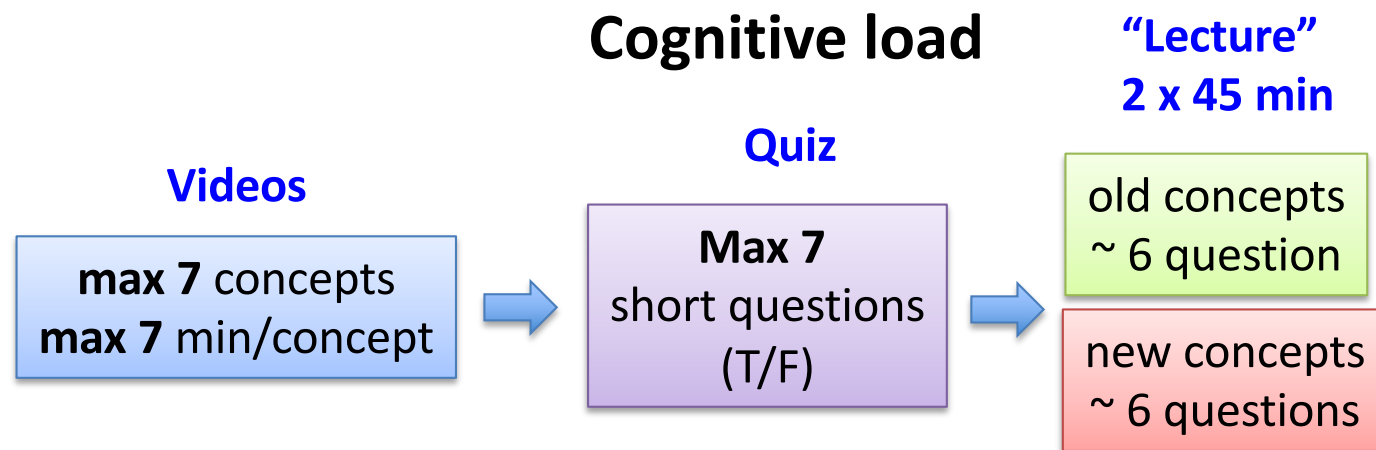
... contain too much stuff (**cognitive load**)

... are “just in case” instead of “**just in time**”

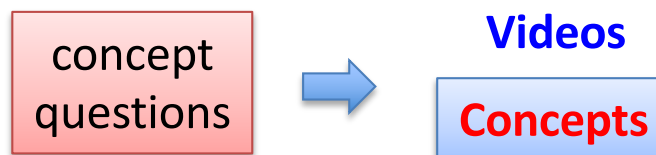
... don't differentiate importance of topics

... pretend the computer/internet doesn't exist

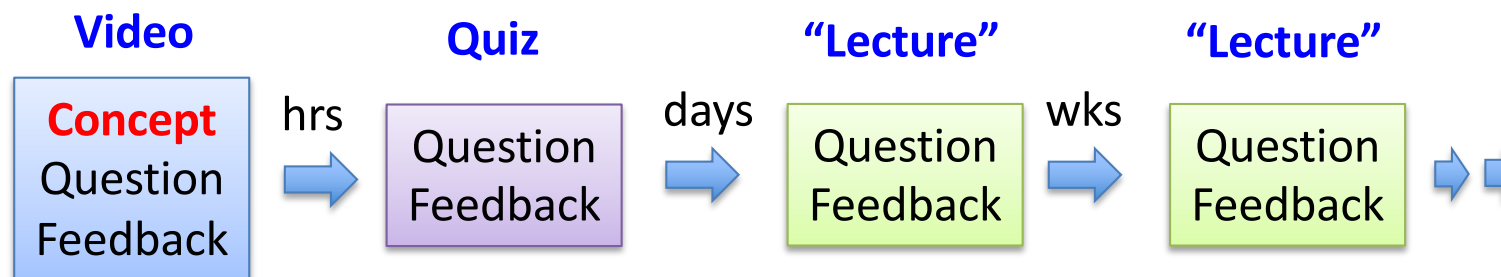




"Just in time" instead of "just in case"



Spaced learning & Formative assessment



Course Design

“Just in time” not “just in case”

**Homework problems => concept questions => curriculum
=> slides => video => quiz**

(not curriculum => problems)

(Research-) Relevant problems = relevant curriculum

What/how is it used? > where does it come from?

De-prioritize anything not contributing to problem solution
(yes, that means you “derivation”)



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<http://m.socrative.com>

Room number 9076



What's the best strategy for winning a new car?

- A. The player should stay with door 1
- B. The player should switch to door 2
- C. It doesn't matter



<http://m.socrative.com>

Room number 9076



What's the best strategy for winning a new car?

$\frac{1}{3}$ chance A. The player should stay with door 1

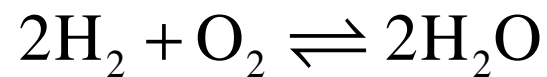
$\frac{2}{3}$ chance B. The player should switch to door 2

C. It doesn't matter

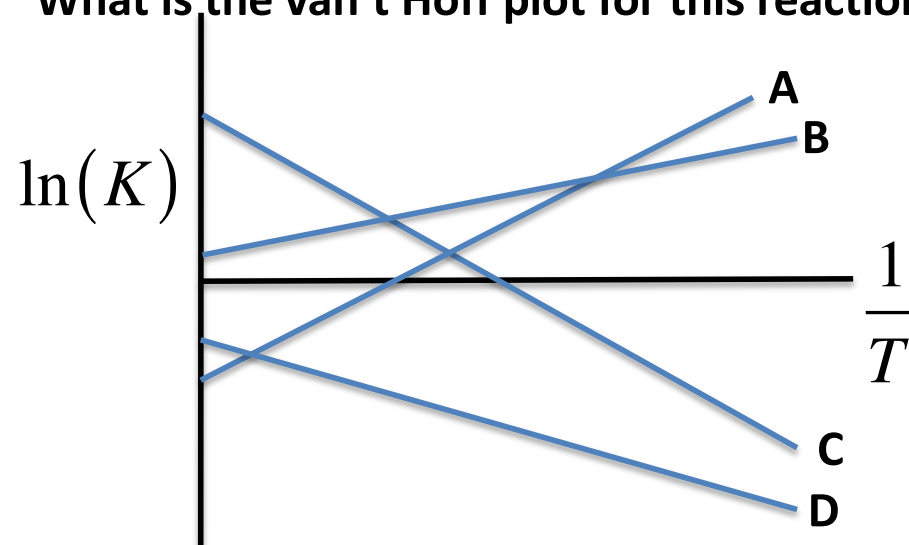


<http://m.socrative.com>

Room number 9076

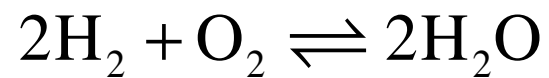


What is the van't Hoff plot for this reaction?

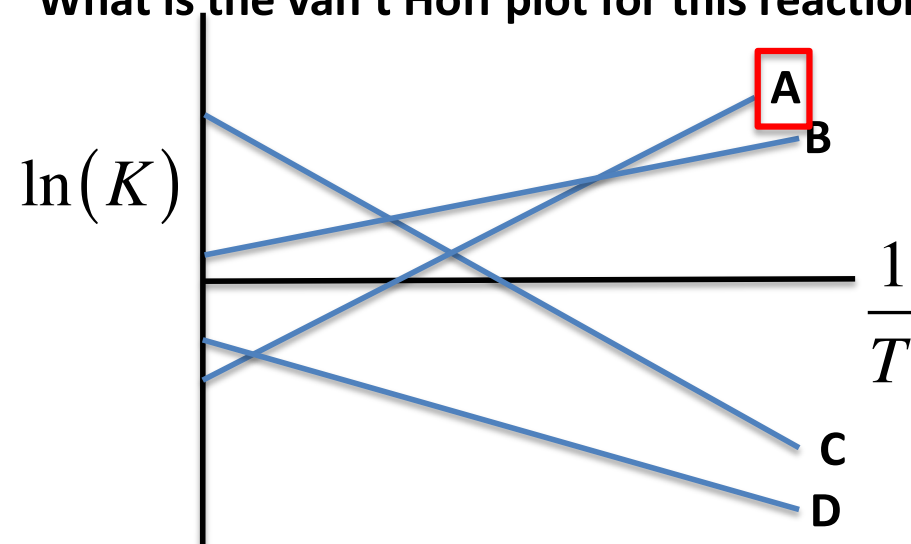
http://youtu.be/qOTgeeTB_kA

E. Don't know





What is the van't Hoff plot for this reaction?

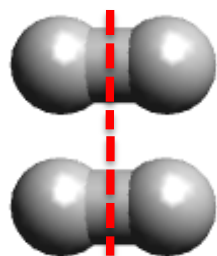


http://youtu.be/qOTgeeTB_kA

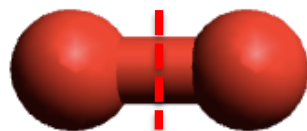
E. Don't know



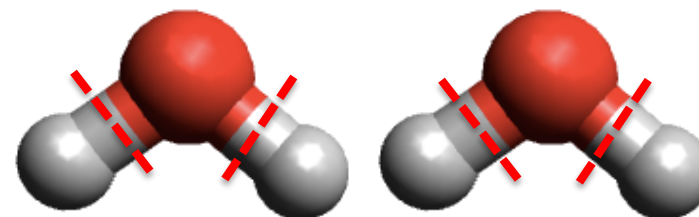
Her vises et van't Hoff plot for en exoterm reaktion



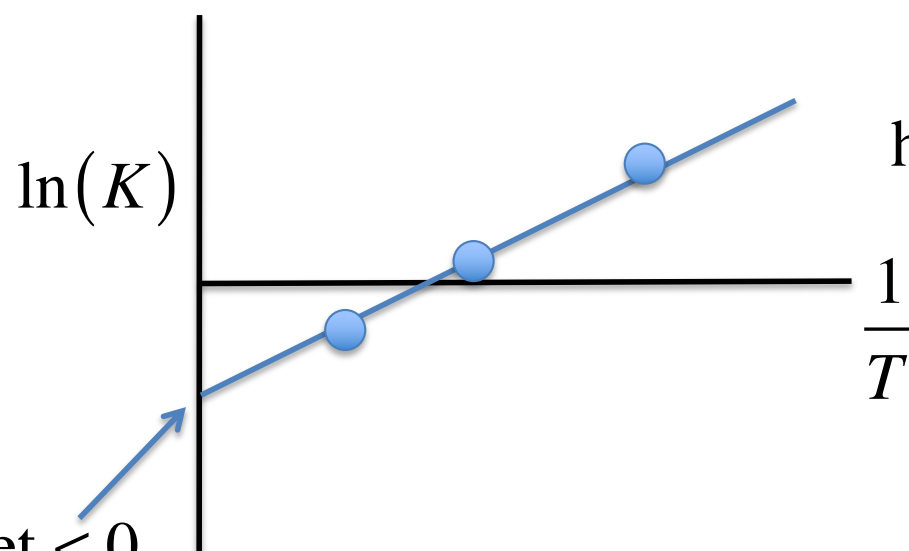
2 x 426



142



4 x 464



$$\text{hældning} = \frac{-\Delta H^\circ}{R}$$

skæringspunktet < 0

$$\Rightarrow \Delta S^\circ < 0$$

$$\text{hældning} = \frac{-\Delta H^\circ}{R}$$

$$\text{hældning} > 0$$

$$\Rightarrow \Delta H^\circ < 0 \Rightarrow \text{exoterm}$$



<http://m.socrative.com>

Room number 9076

The limiting Debye-Hückel law

$$\gamma_{\pm} = 10^{-|q_+q_-|A\sqrt{I}} \quad I = \frac{1}{2}(q_+^2[+] + q_-^2[-])$$

Based on this equation what is probably **not** true

- A. $\gamma_{\pm}$ approaches 1 as the ion concentration decreases
- B. other things being equal, Zn^{2+} has a smaller $\gamma_{\pm}$ than Br^-
- C. $\gamma_{\pm}$ is 0 for neutral molecules
- D. 0.01 M CaCl_2 has a larger $\gamma_{\pm}$ than 0.01 M CaSO_4
- E. Don't know



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- A. $\gamma_{\pm}$ approaches 1 as the ion concentration decreases
- B. other things being equal, Zn^{2+} has a smaller $\gamma_{\pm}$ than Br^-

$\gamma_{\pm} \approx 1$

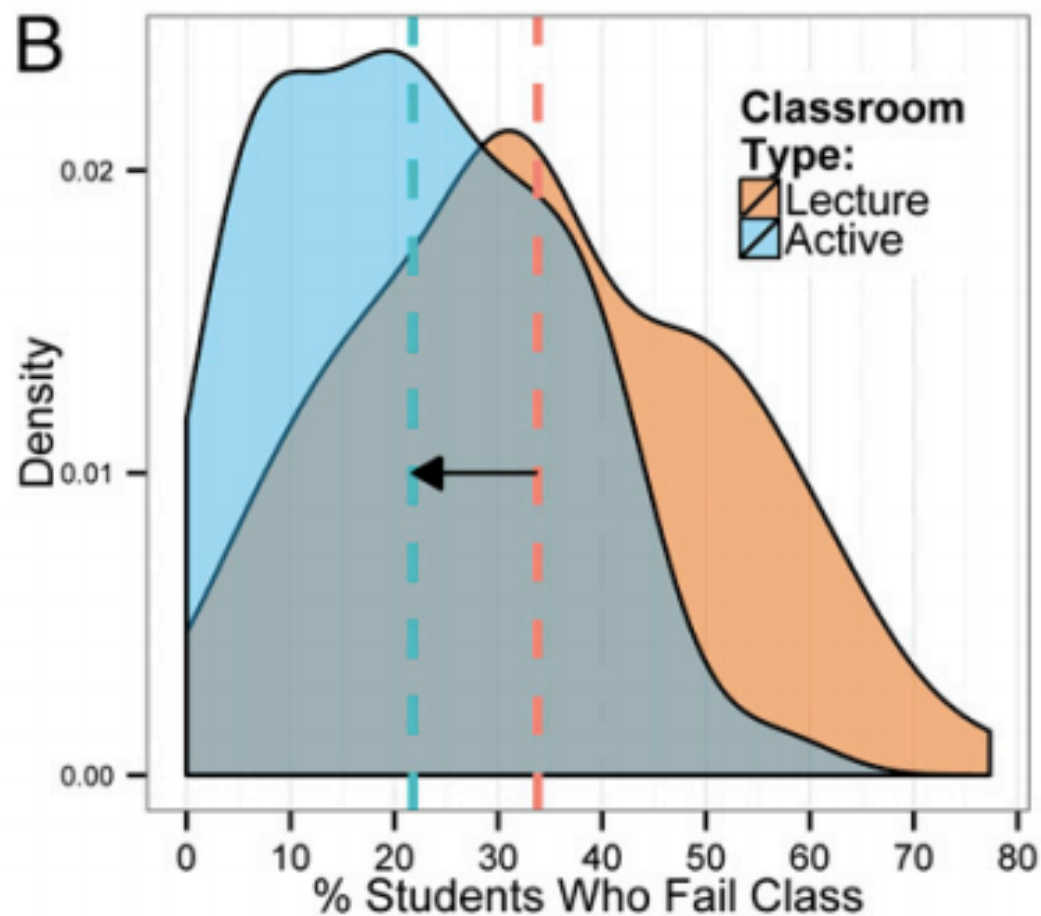
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D. 0.01 M CaCl_2 has a larger $\gamma_{\pm}$ than 0.01 M CaSO_4

E. Don't know



Does active learning work?



Mean failure rate in STEM courses reduced from 33.8% to 21.8%

Summary

Tools

in class voting: **socrative.com** (free/ < 50)

Pre-class quizzes: KU = Absalon

Video lecture: PPT + **Screenflow/Camtasia** (~1000 DKK)

Pen cast: iPad + **Explain Everything** (30 DKK) + Stylus (300-800 DKK)

Immediate feedback on homework: **PeerWise** (free)

Simulations/experiments: **Molecular Workbench/Youtube**

Concepts

(or how to talk like a “didactician”)

Active learning: learning by doing

Flipped classroom: home = lecturing & in-class = questions

Peer Instruction: better learning from peers through discussion

Cognitive load: you can learn up to 7 *new* things at a time

Spaced learning: it doesn't stick until you've seen it 3-4 times over a period of time

Formative assessment: you learn by answering questions if you get **immediate** feedback

Just in case vs time: “You'll need to know this later” is not a good motivator



Ideas for Getting Started



The usual: lecture 20-30 min -> question (put to sleep/wake up/repeat)

Not convinced? Try this experiment

1. Make a reading quiz on a topic you would like to skip in lecture and that you feel the book explains well
2. Make 1-2 in-class questions, that if >75% gets correct, makes you comfortable skipping topic in lecture
3. Repeat very similar in-class question next week

Convinced?

Year 1: Replace parts of lecture where you repeat textbook with quiz/in-class question

Year 2: Record the lectures where you deviate from book: lecture period = all questions

Year 3: Rethink course: is the book helping or hurting? Does it cover what you want in the order you want it?



Some inspiration

Confessions of a converted lecturer

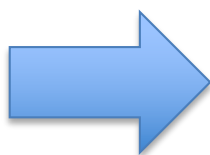
<http://youtu.be/WwslBPj8Ggl> (1 hr)

<http://youtu.be/rvw68sLlfF8> (20 min)

<http://youtu.be/hbBz9J-xVxE> (5 min)

Excellent advice on teaching from Nobel Laureate Carl Wieman

<http://proteinsandwavefunctions.blogspot.dk/2013/07/excellent-advice-on-teaching-from-carl.html>



Active Learning: Tools and Tips – an ebook

<http://tinyurl.com/janstips>

The 5 minute university

<http://youtu.be/kO8x8eoU3L4>

Slides from this talk:

<http://proteinsandwavefunctions.blogspot.com/2014/11/i-lecture-no-more.html>

An older version of this talk:

<http://youtu.be/9sPusuY3a1c>

