How to keep students engaged when teaching at a distance

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Sweden

First: a few words about myself

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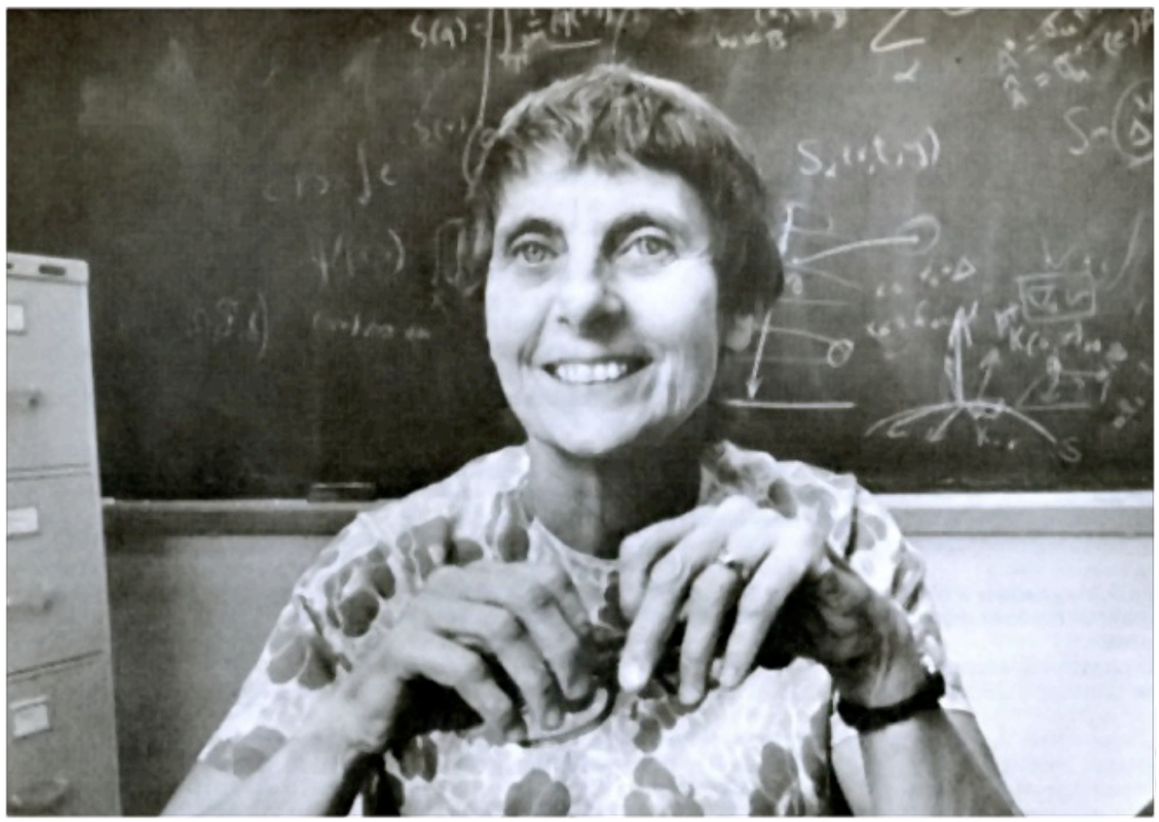
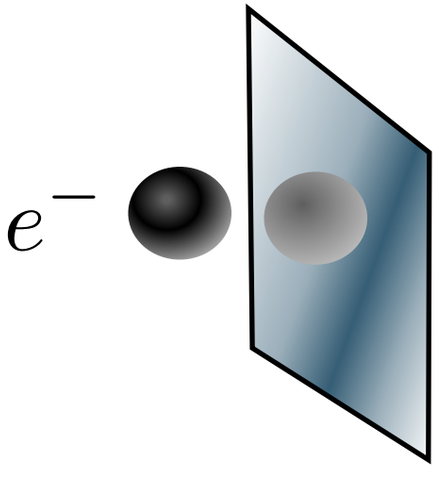
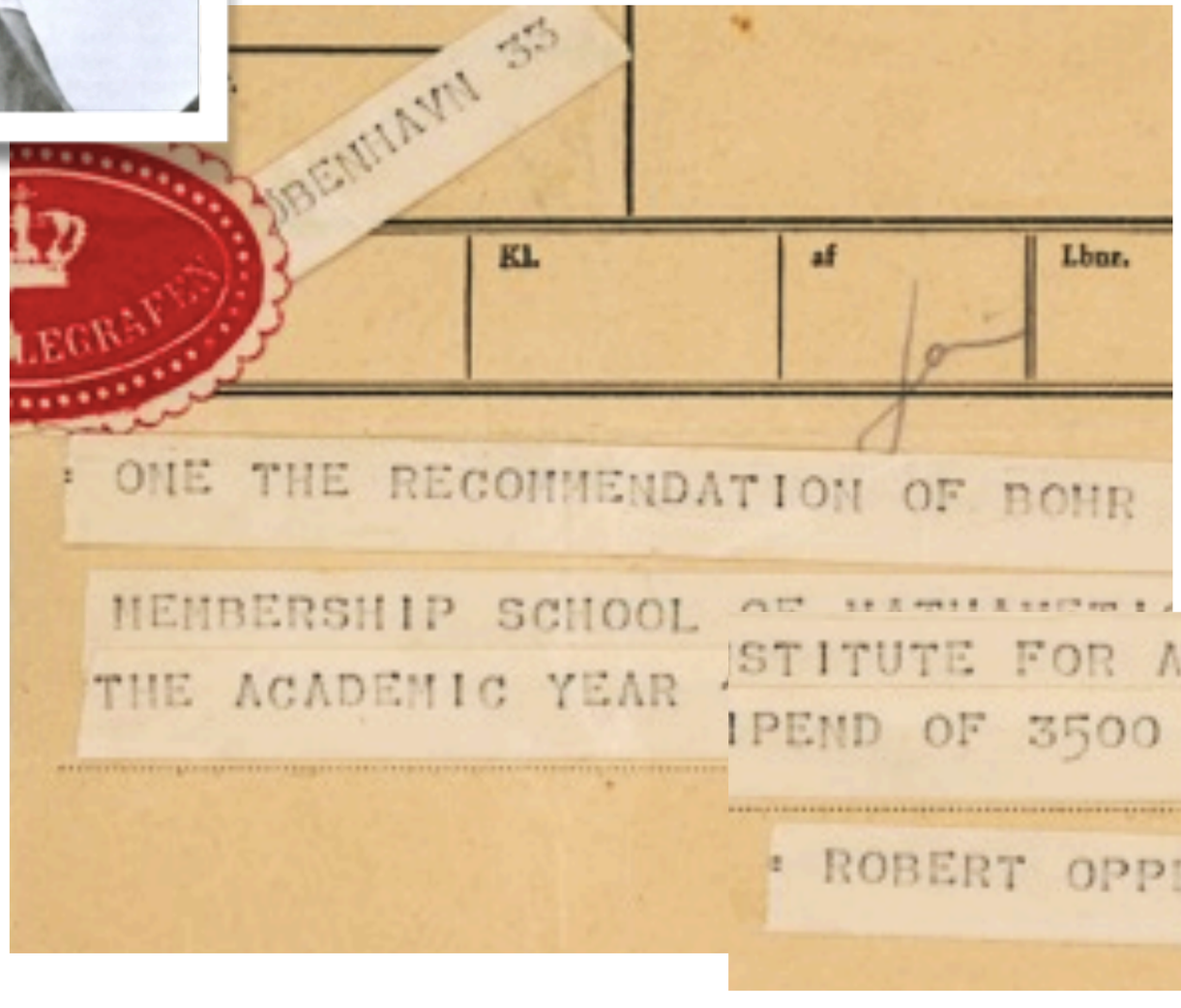


”In Princeton, she often walked with Albert Einstein to their respective offices at the Institute for Advanced Study.”

my teacher (supervisor):
Cécile DeWitt-Morette
(1922-2017)



relativity and quantum physics

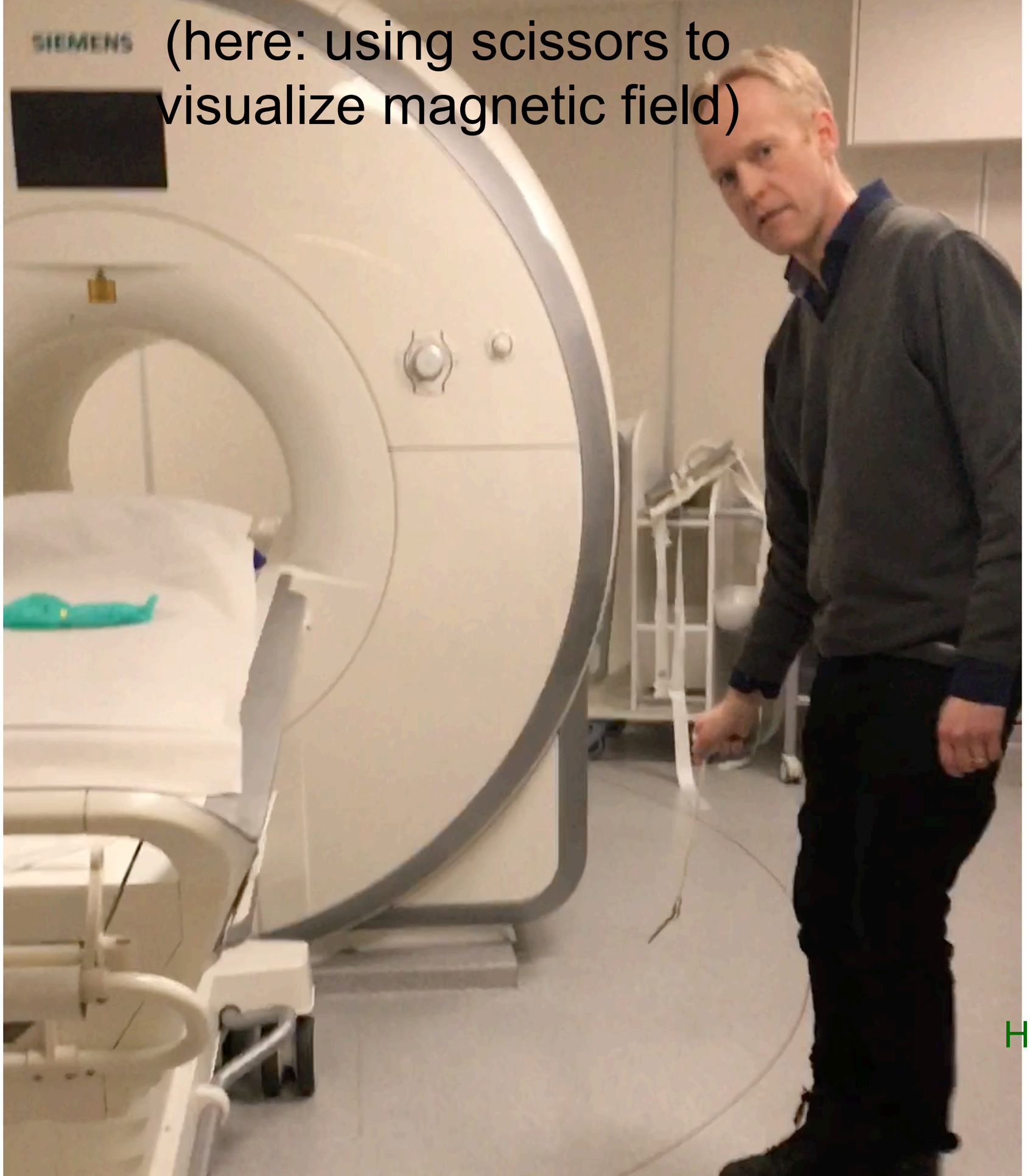


Physics Today (2017), DOI:10.1063/PT.6.4.20171010a

Applied physics:

MRI medical physics

(here: using scissors to visualize magnetic field)

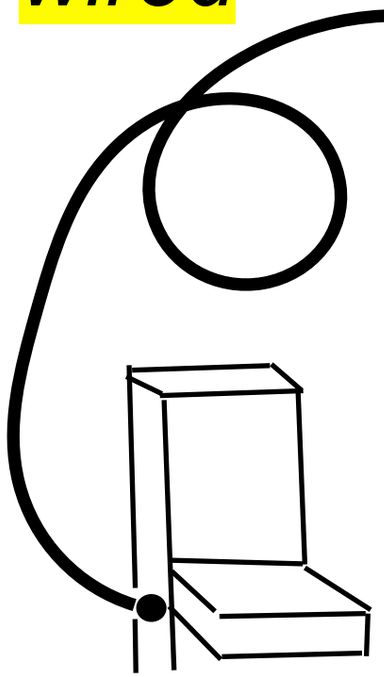


with Jakob Heydorn-Lagerlöf, Aleksander Blagoiev

another teacher:

Charles Chiu
Distinguished Teaching Professor
University of Texas at Austin

wired



ancient clicker

”In 1991, there were about 2000 students per year […].
In the summer of 1996, I supervised installation of […]
a wired classroom communication system […]
when used skillfully keeps students more engaged”

web2.ph.utexas.edu/utphysicshistory/CharlesChiu.html

Peer instruction

”making the classroom an interactive social experience”
(Mazur, 2019)

synchronous (e.g. traditional lecture)

↕ **flip**

asynchronous (e.g. ”homework”)

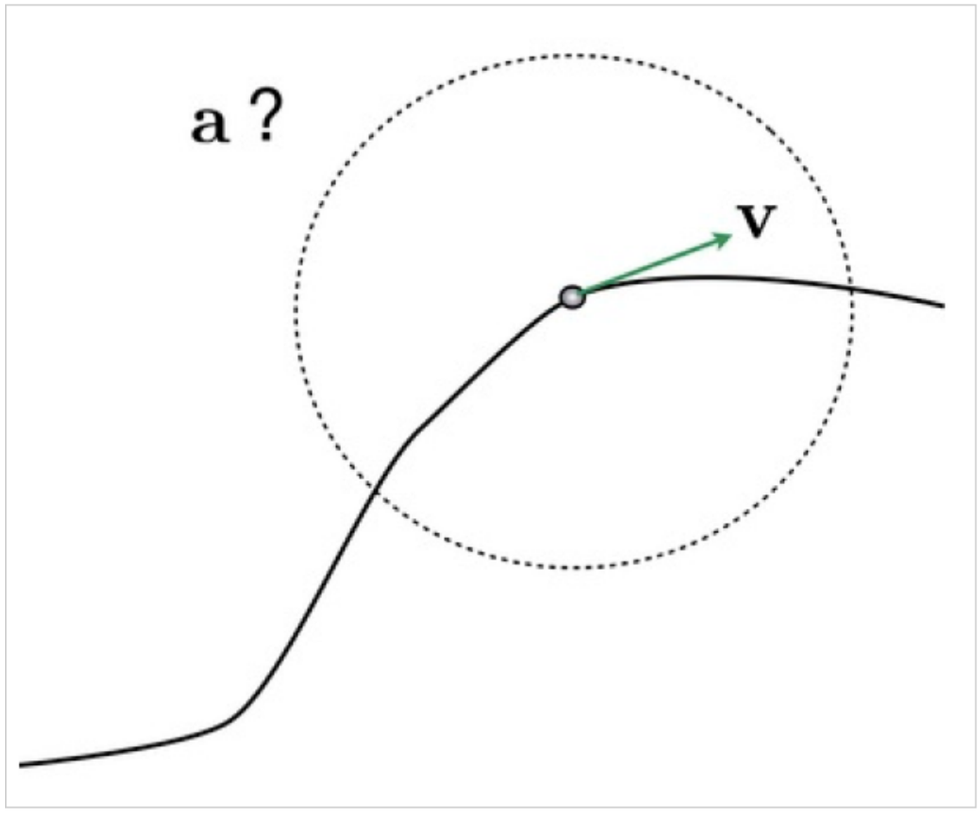
Peer instruction

”making the classroom an interactive social experience”
(Mazur, 2019)

<u>One recipe for structured discussion:</u>

1. Instructor asks question (multiple choice, drawing, …), students answer individually on smartphones. No talking!
2. If few (<30%) or many (>70%) correct, exit. Otherwise:
3. Students <u>discuss answers with each other</u>, about 2-3 mins
4. Students answer individually, again

Peer Instruction with Learning Catalytics

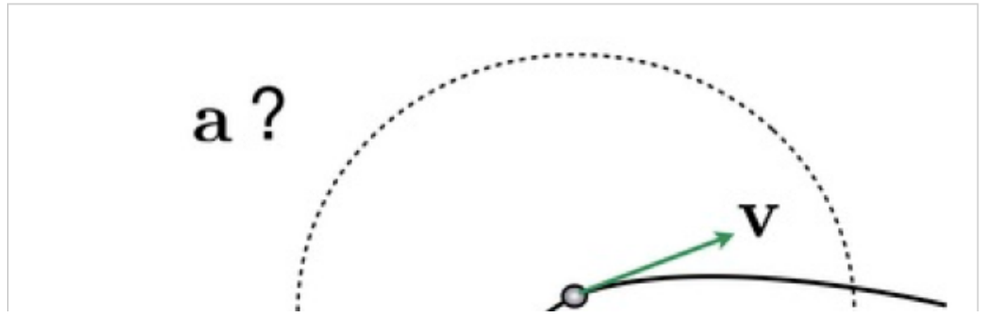


see also
e.g. webinar
by Nevalainen, 2015

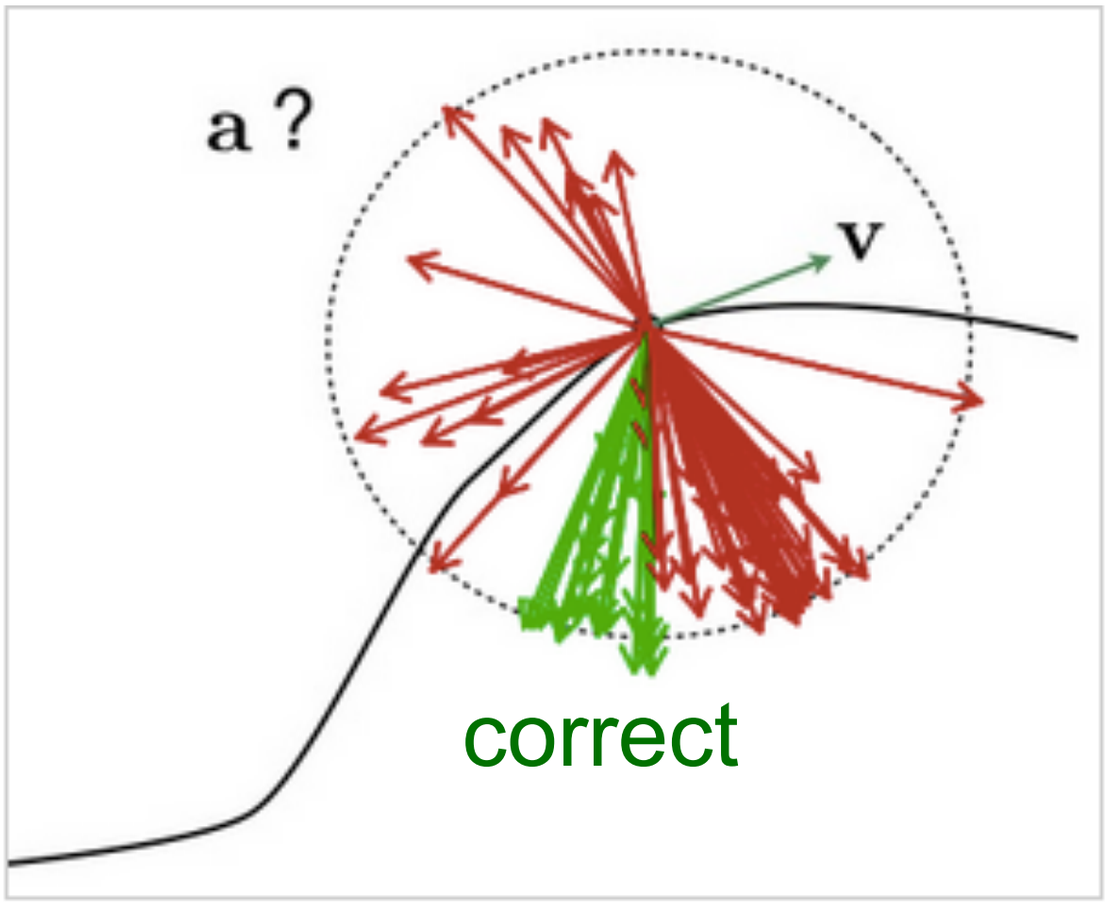
This picture appears on student's **smartphone** (or iPad, or..)

Student is asked to draw "acceleration vector",
an arrow in the dotted circle: what direction?

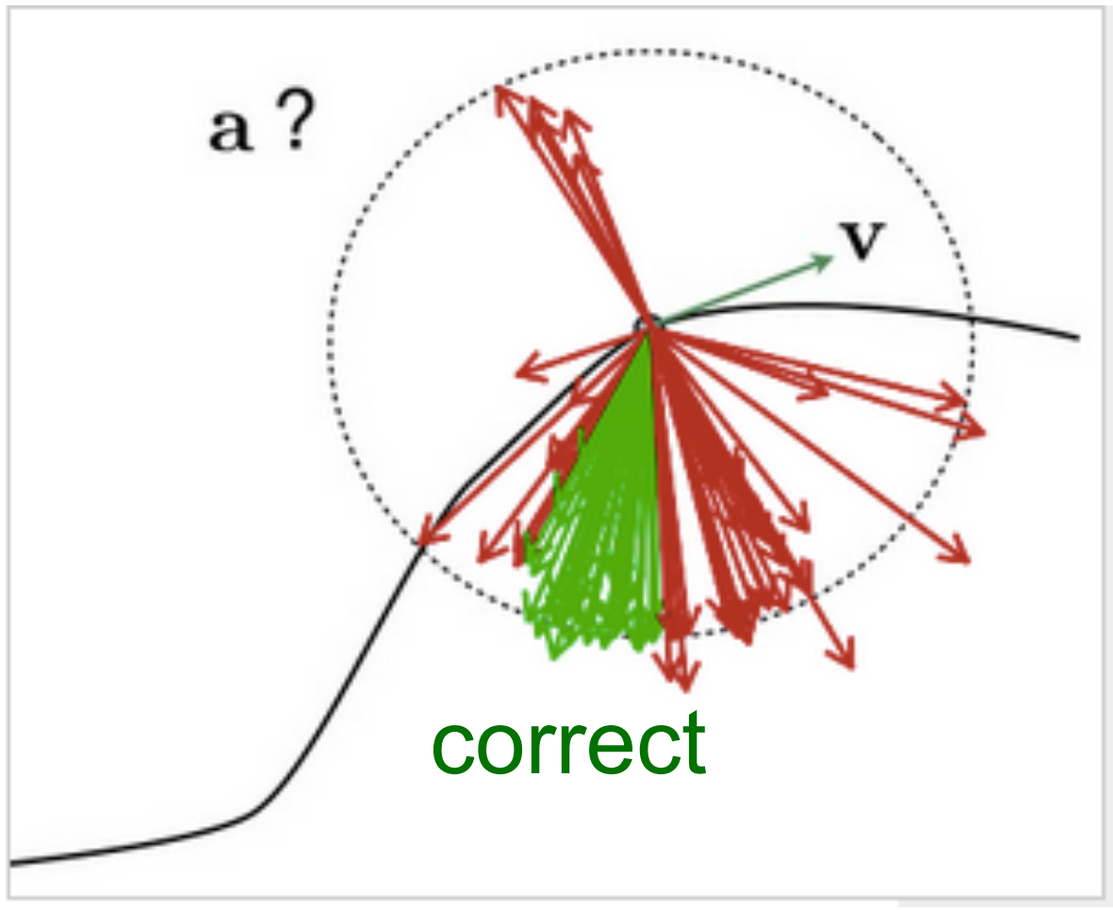
Peer Instruction with Learning Catalytics



my class, 2015



before peer instruction



after peer instruction

are the blind leading the blind?

Peer Instruction with Learning Catalytics

”making the classroom an interactive social experience”
(Mazur, 2019)

Another example: multiple choice question: A,B,C,D

detail of seat map **before** discussion,
my mechanics class, 2019

Peer Instruction with Learning Catalytics

”making the classroom an interactive social experience”
(Mazur, 2019)

Another example: multiple choice question: A,B,C,D

asynchronous

”Design principle 7: […] *building a learning community”*

M.K. Kim, S.M Kim, O. Khera, J. Getman (2014),

The experience of three flipped classrooms in an urban university: an exploration of design principles,
Internet and Higher Education 22, 37–50.

Peer Instruction with Learning Catalytics

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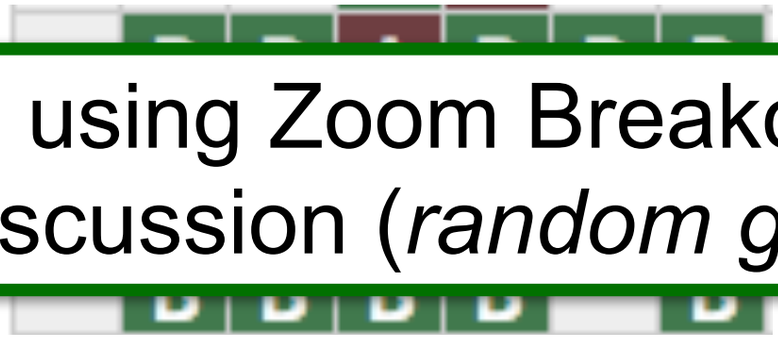

distance: using Zoom Breakout Rooms for discussion (*random groups*)

What about **assessment**? In my opinion, grades for ”correct answers” would make it less useful as ”fluid” discussion device

”Desig *nity”*

M.K. Kim, S.M Kim, O. Khera, J. Getman (2014),

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”Practical Exercise”

Wieman & Holmes (2018):
Problem: large-scale undergraduate labs accomplish some ”technical” learning outcomes (use hi-tech equipment, write formal lab reports) but completely neglect conceptual learning outcomes: students learn ”button-pushing”

Wieman-Holmes solution: train lab assistants better

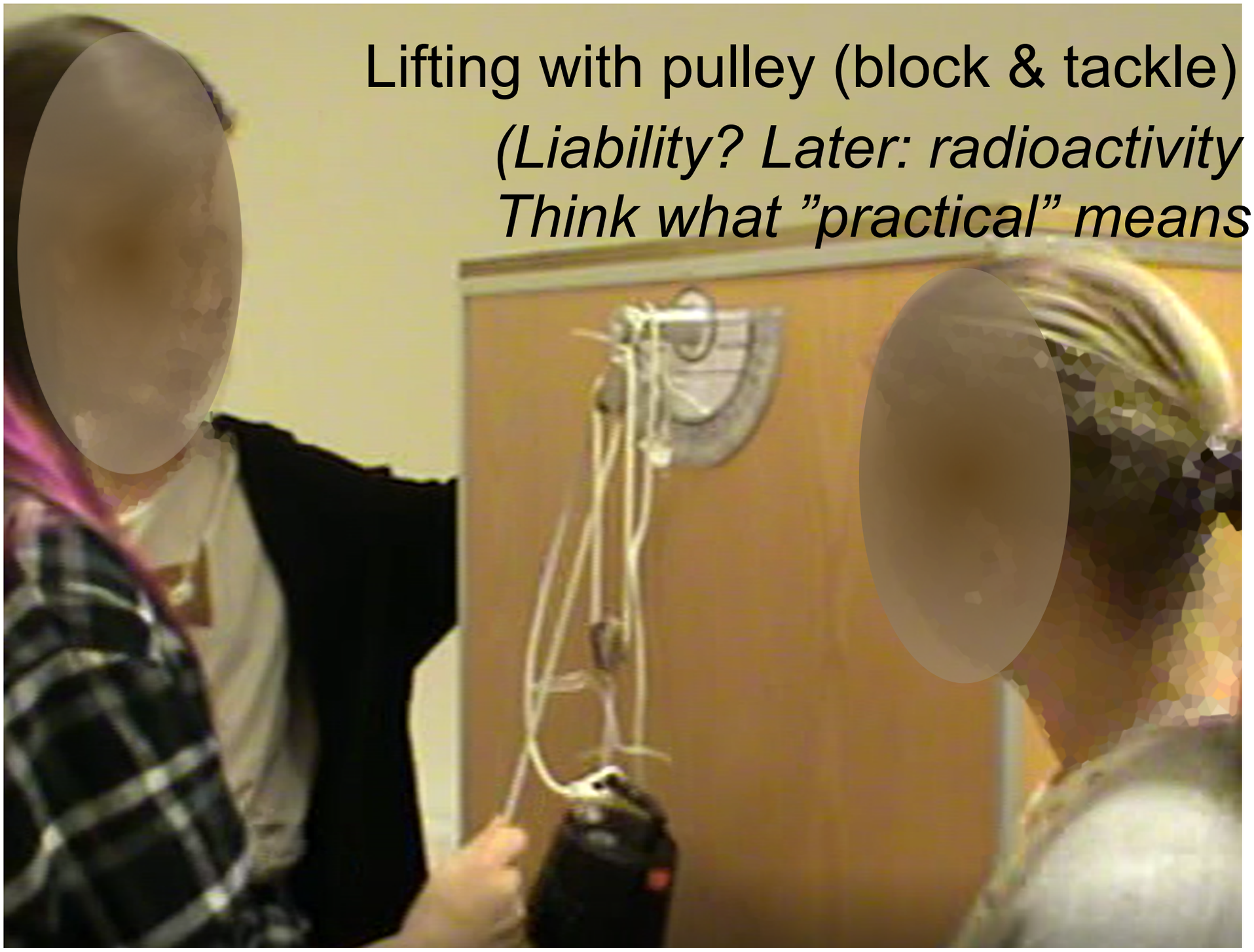
- Our proposed solution: separate lab activity, **”Practical Exercise”**.

  Focuses only on conceptual, leave technical outcomes to other activities. Huge use of teacher resources?

Haglund, Andersson, M.B. (2019)

”Practical Exercise”

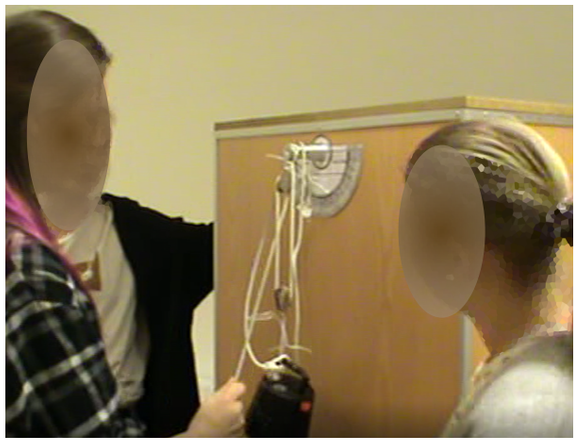
Peers do the **instruction**.
Leave minimal info in room, with minimal equipment.



Lifting with pulley (block & tackle)

(Liability? Later: radioactivity lab!
Think what ”practical” means to you)

2018 filming (Andersson & Haglund)

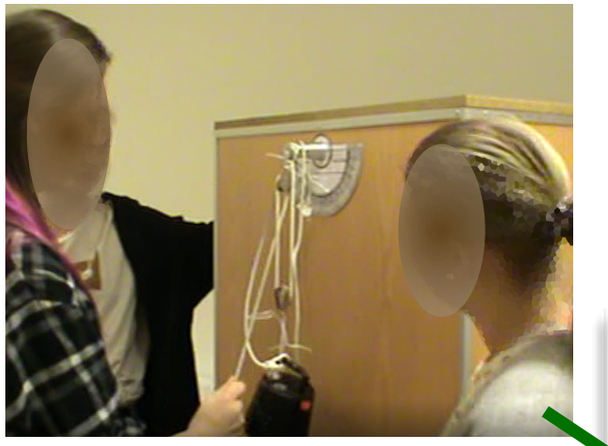


discussion starts (surprise, confusion)

- *No, can it really be like this...? That I pull here, and I can lift however much I like, really... is that true...? And it really is!*

Haglund, Andersson, M.B. (2019)

Assessing ”Practical Exercises”



discussion starts (surprise, confusion)

Mastering Engineering (web browser)

Mekanik

Item Details

Vecka 15, torsdag (Statik kap 4)

Praktisk uppgift i mekanik 1

Praktisk uppgift 3 handlade om att lyfta en tung vikt på

Part A

Om du får anta att trissorna är ideala (försumbar massa, snurrar utan friktion) och vikten vägde 3.9 kg , vad va repet som löper via trissorna? Antag att repbitarna mellan trissorna löper vertikalt.

ANSWER:

$\frac{m \cdot 9.82}{2} = 19.1\,\mathrm{N}$

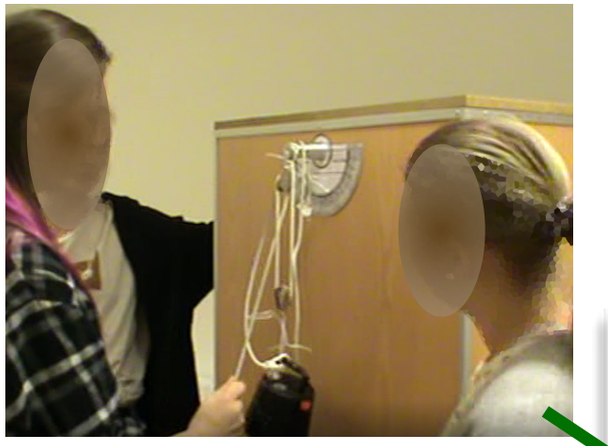
Answer Stats:	Students	% Correct	% Unfinished	% Req'd Solution	Wrong/stud
System Average	132	99.2%	0%	0.8%	0.2
This Course (berg99688)			*(no data)*		

Algorithmic question: unique number input for each student

unique number answer for each student

Haglund, Andersson, M.B. (2019)

Following up ”Practical Exercises”



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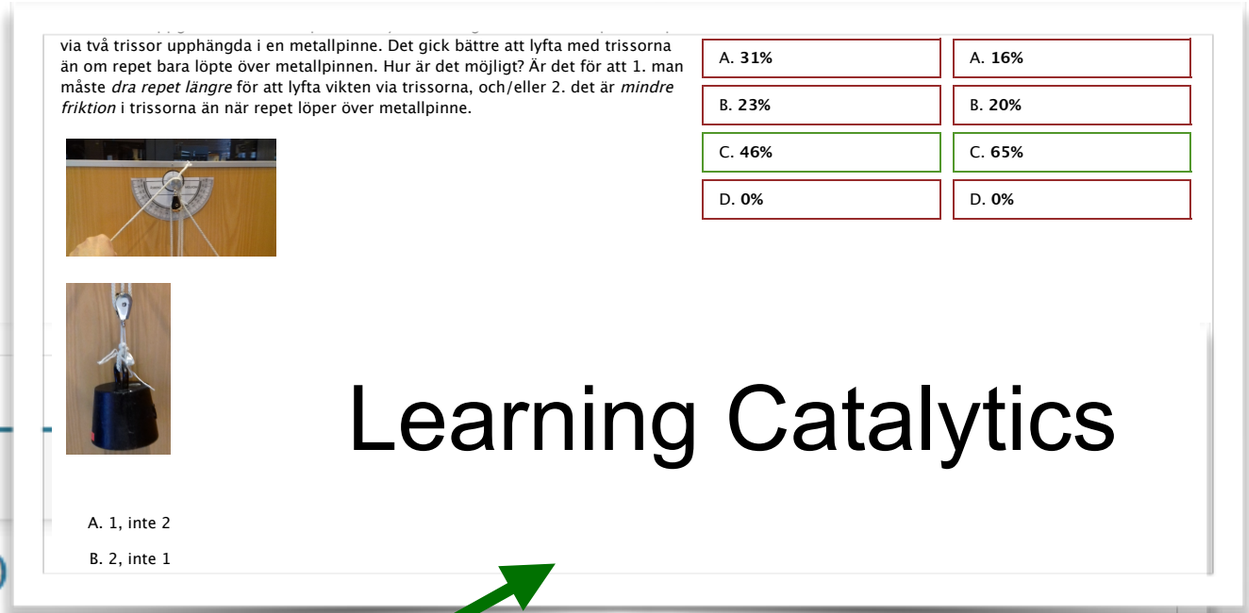
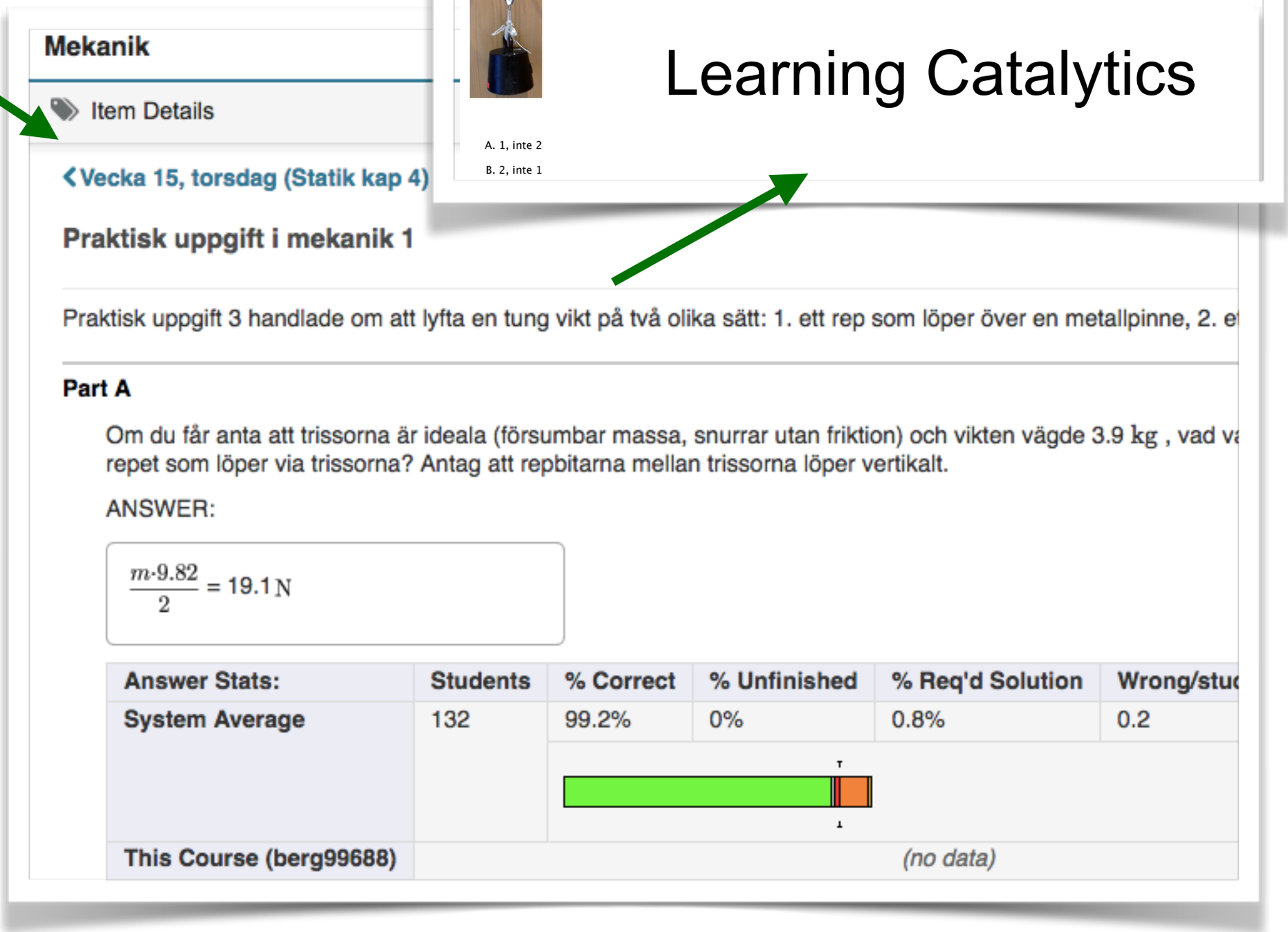


Learning Catalytics



Haglund, Andersson, M.B. (2019)

Mastering Engineering (MyLab, etc.)

current assessment: ”bonus points count towards final exam”
equivalent to ”grade = 30% homework, 70% final”

this semester: “high-stakes” final exam (always have 5h),
+ take photo at home of handwritten calculations, submit

Praktisk uppgift i mekanik 1

Praktisk uppgift 3 handlade om att lyfta en tung vikt på två olika sätt: 1. ett rep som löper över en metallpinne, 2. e

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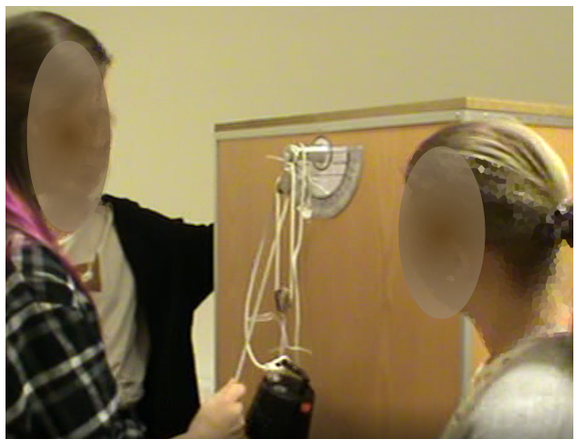
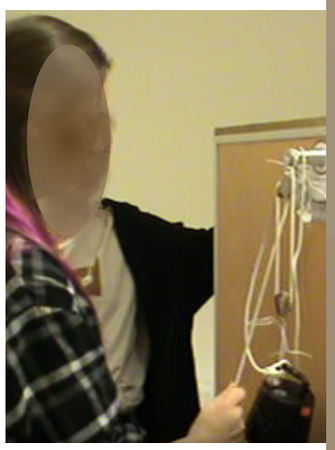
Peer Instruct During a Pandemic?

- Zoom is fine (but real-world face-to-face is better)
- Do-It-Yourself (DIY) ”Practical Exercise” at home isn’t bad (but our equipment is better)



Do-It-Yourself (DIY) at home is not bad



inelastic
smooth
ribbon/rope

heavy
household
object
with hole

YouTube Channel: ”marcus berg physics”

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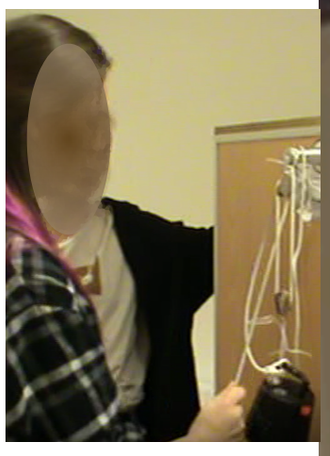

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Mastering + Student video submission

assess/grade

get ideas from students!

Mekanik

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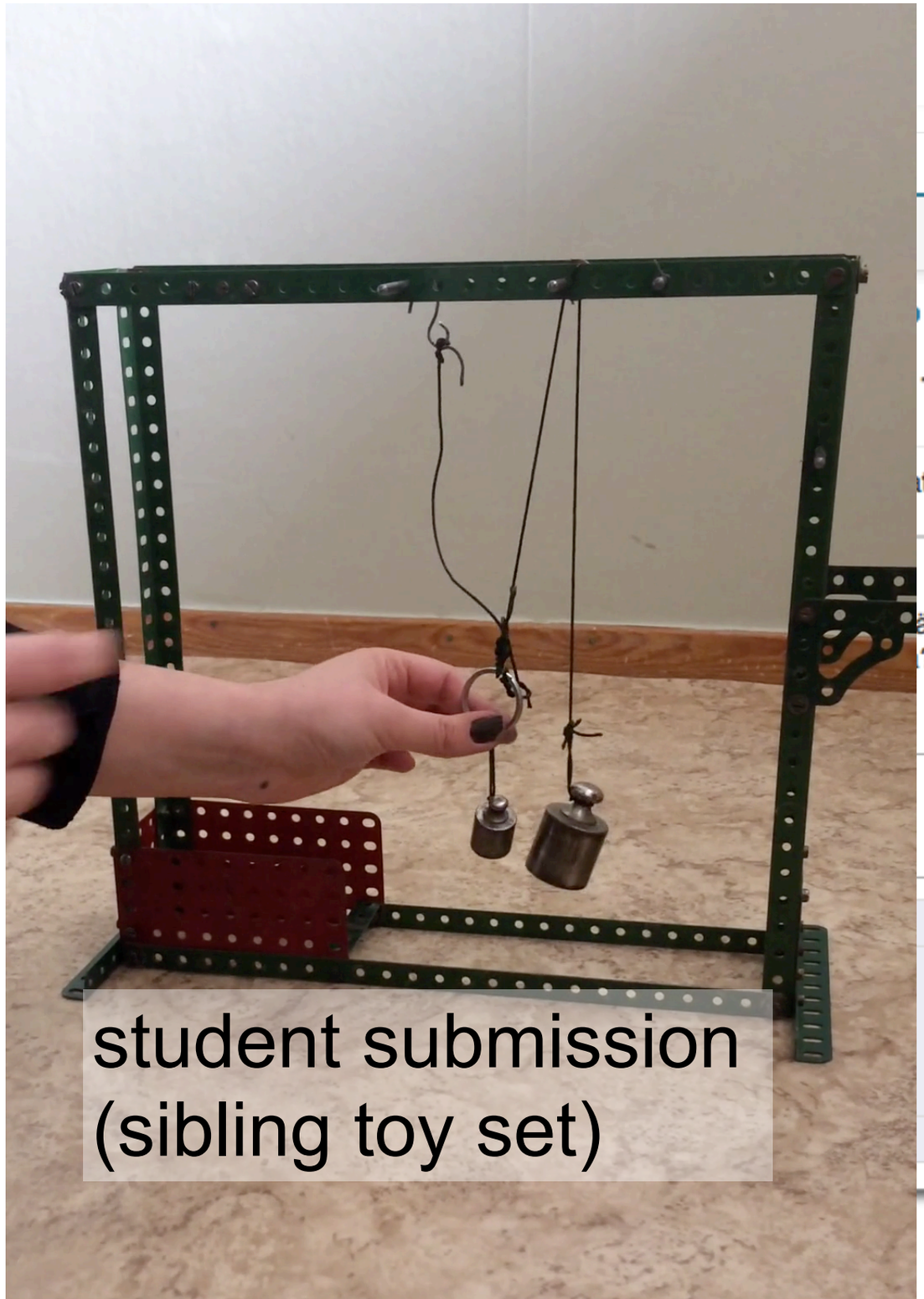

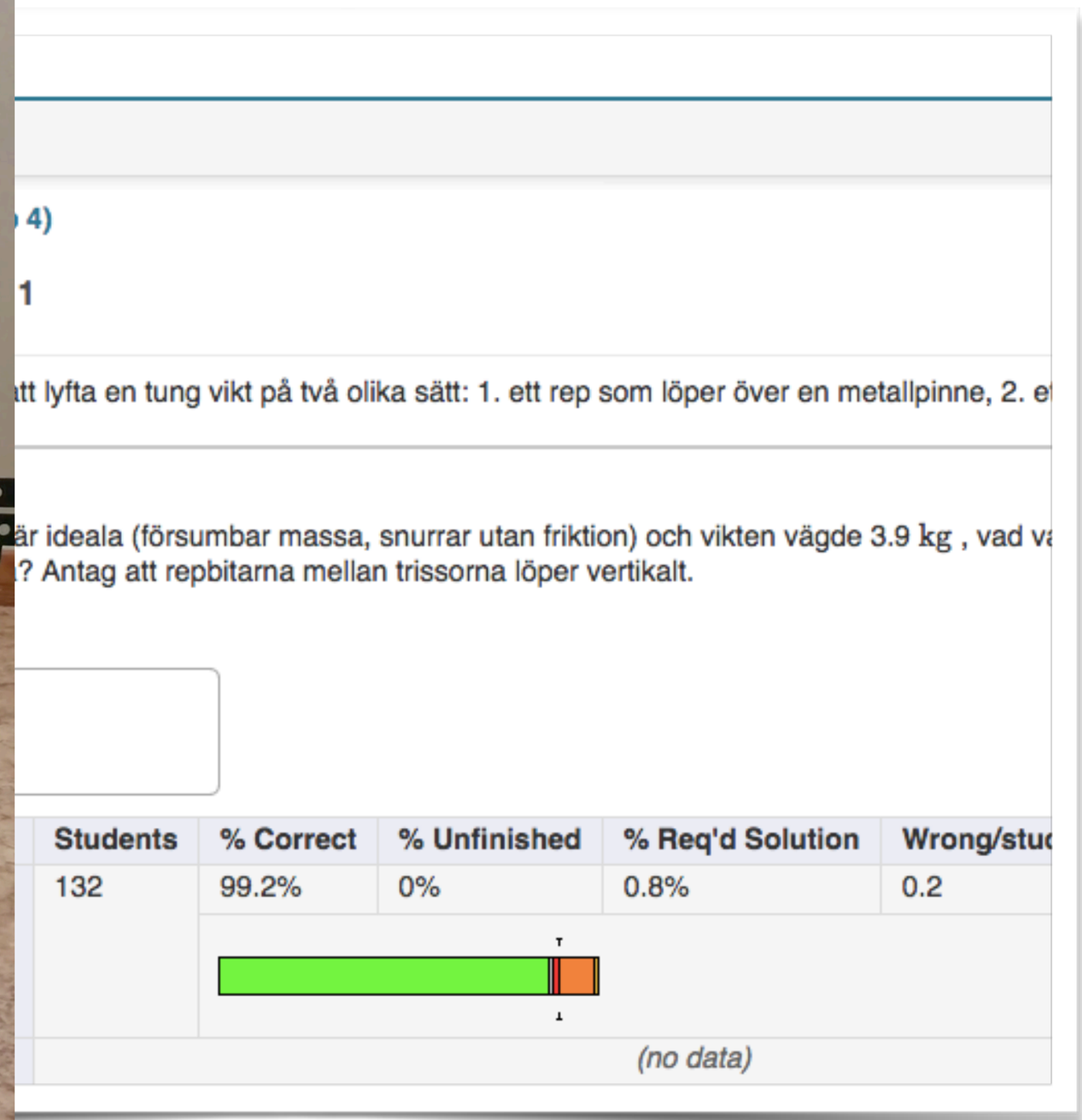

Other courses

- Mechanics is easier DIY than, for example, quantum physics, or business
- For quantum physics, teacher performs visual demonstration

e.g. ”radioactivity” lab with prepared sample

↘

”*are there radioactive particles in this room*?”

At home: use mechanical analogy, e.g. balls for ”particles”

Other courses

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↘

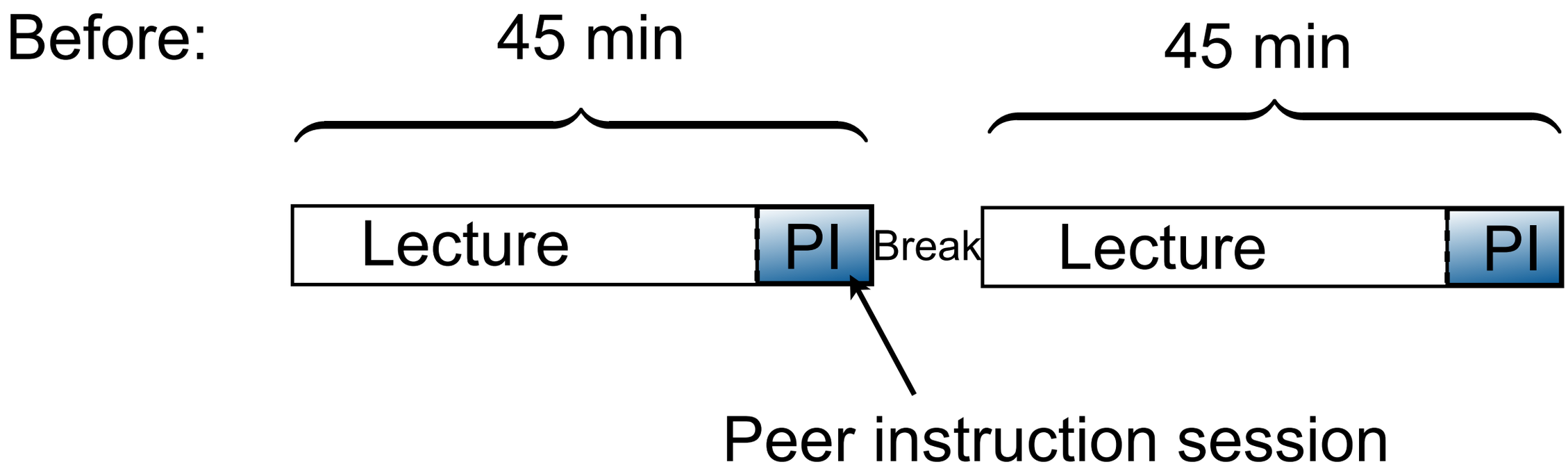
”are there radioactive particles in this room”

At home: use mechanical analogy, e.g. balls for ”particles”

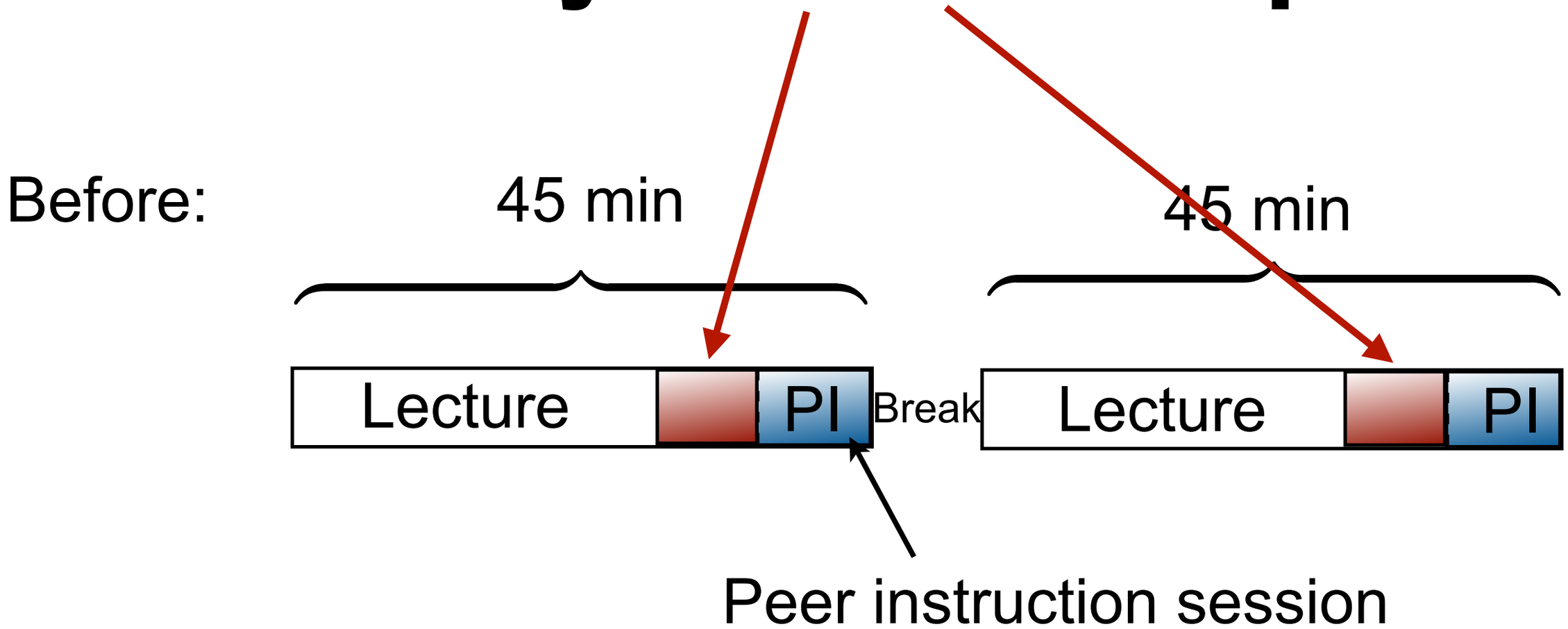
could you implement Do-It-Yourself ”Practical Exercise”,
also for non-STEM subjects?
Let’s do some quick brainstorming!

marcus.berg@kau.se

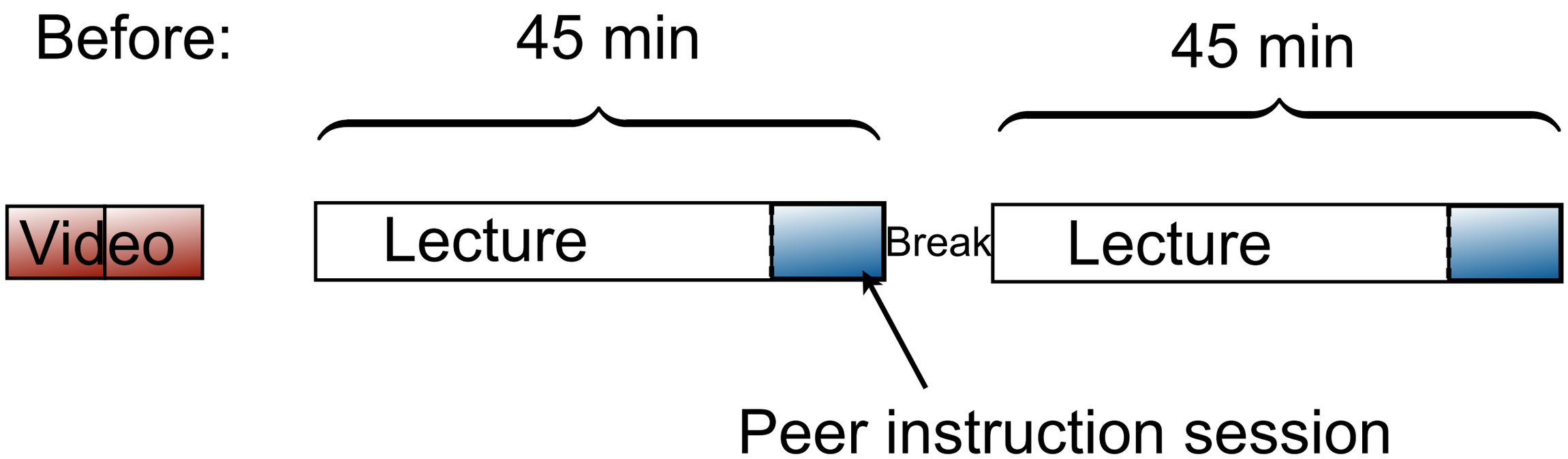
But my schedule is already packed?



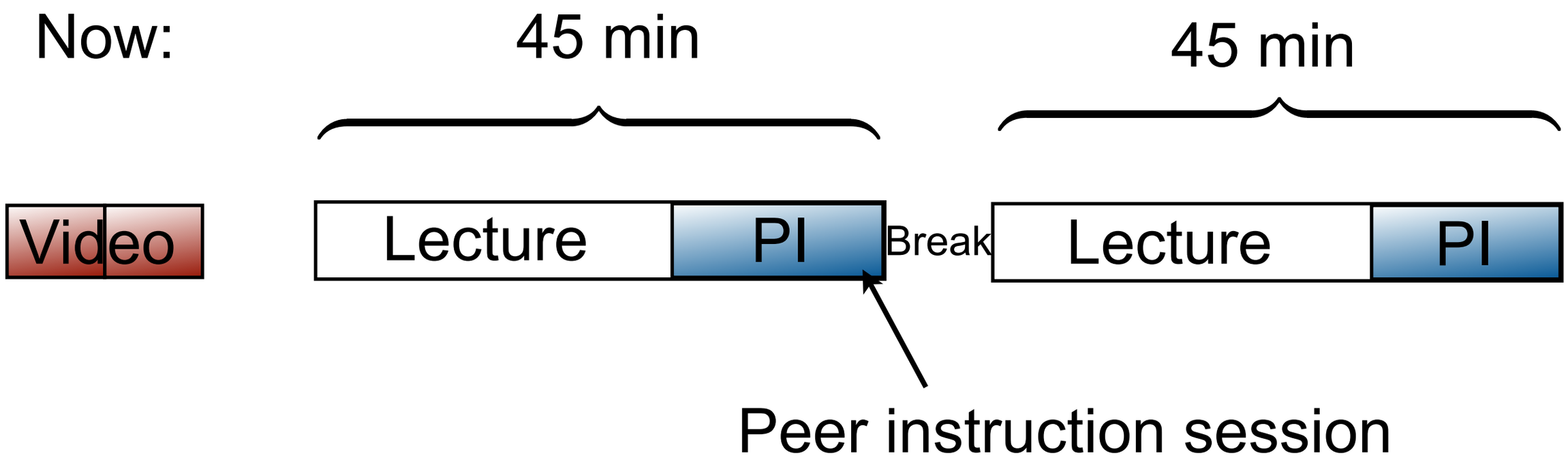
Identify sections to flip



Flip to <u>before</u> lecture



Budget “social interaction time”



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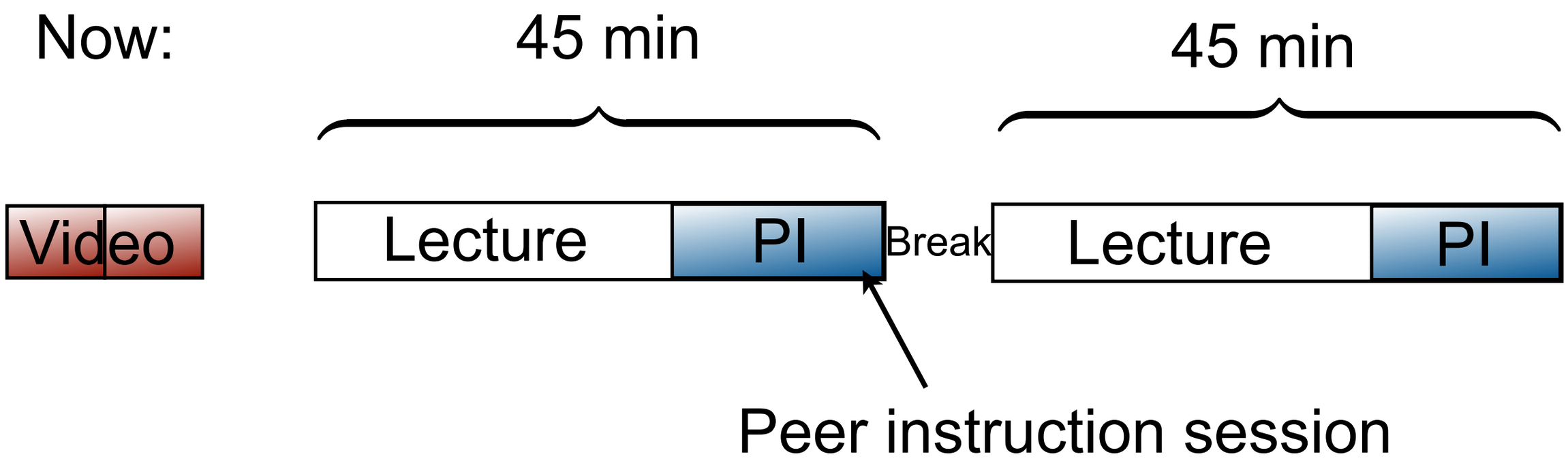

Flipping can be useful for several reasons,

here: specifically to free up time for peer instruction