

# Activating blended learning approaches in two freshmen chemistry courses

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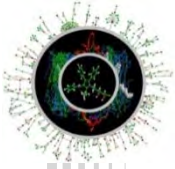
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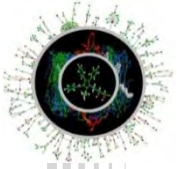




# Problems, aims & hypothesis

- **Problems**
  - **General:** Classical lecturing ineffective
  - **Specific:** 1<sup>st</sup> year bachelor courses: high school to university
- **Aim: activate & involve students**
- **Hypothesis**
  - Increase in engagement, motivation and performance





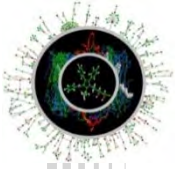
# The approach

- **Blended Learning: mix online/offline teaching**
  - More responsibilities/active role for students

Recycling recorded lectures as  
online slidecasts

Blended Learning





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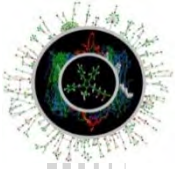
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Onderwijs 19 februari 2016

## Rechtenstudenten tegen afschaffen online hoorcolleges: 'Dit is een stap terug'



De faculteit Rechtsgeleerdheid wil hoorcolleges in de bacheloropleiding niet meer online aanbieden, omdat ze vindt dat studenten maar naar de colleges moeten komen. In het eerste jaar zijn ze al afgeschaft, en volgend jaar verdwijnen ze helemaal. De facultaire studentenraad is tegen. Raadslid Rosalie de Jonge: 'Dat is een stap terug.'



# The approach

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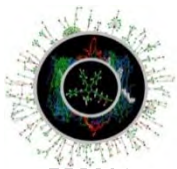
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**Onderwijs** 24 mei 2019

## Dit is waarom faculteiten hun colleges niet meer online zetten

Studenten willen graag dat hoorcolleges online beschikbaar zijn, maar de VU wil geen bingewatchers en lege zalen.

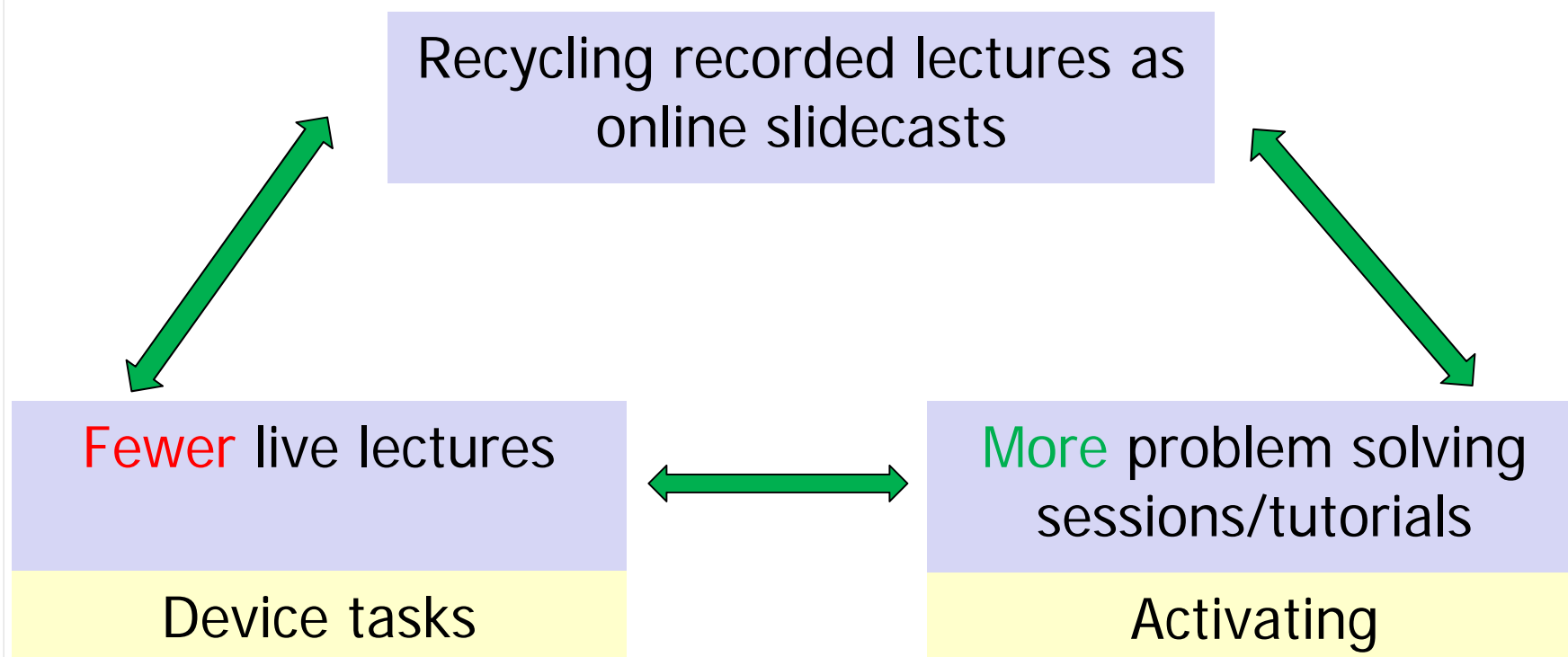


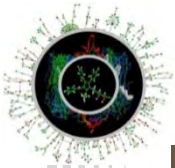


# The approach

- **Blended Learning: mix online/offline teaching**
  - More responsibilities/active role for students
  - Supplemented with additional activating tasks

Blended Learning





# The approach

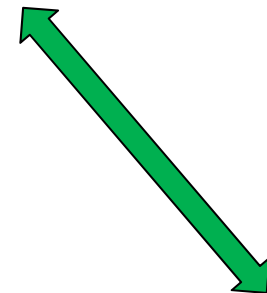


online/offline teaching

able for students

activating tasks

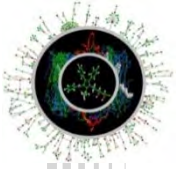
Recorded lectures as  
podcasts



More problem solving  
sessions/tutorials

Activating

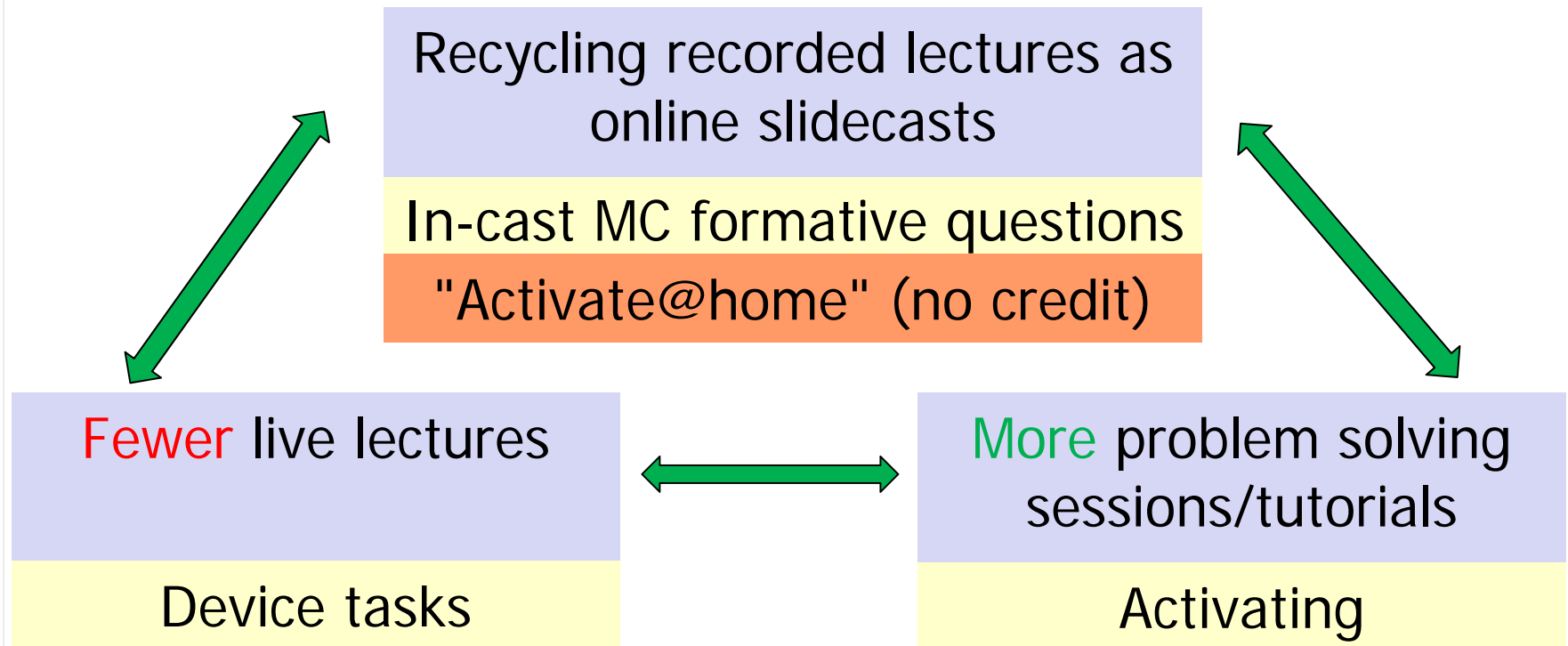
Teachers still pillars!



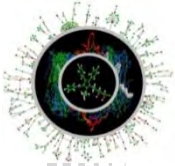
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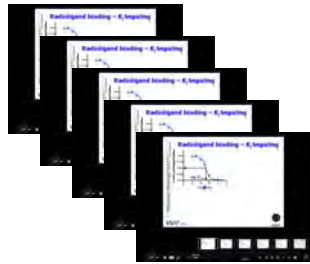




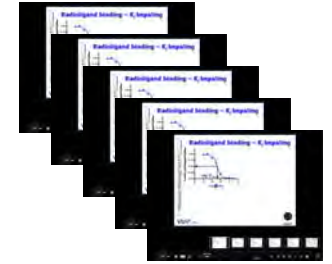
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Blended Learning



Recycling recorded lectures as  
**online slidecasts**

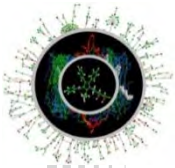


Fewer **live lectures**



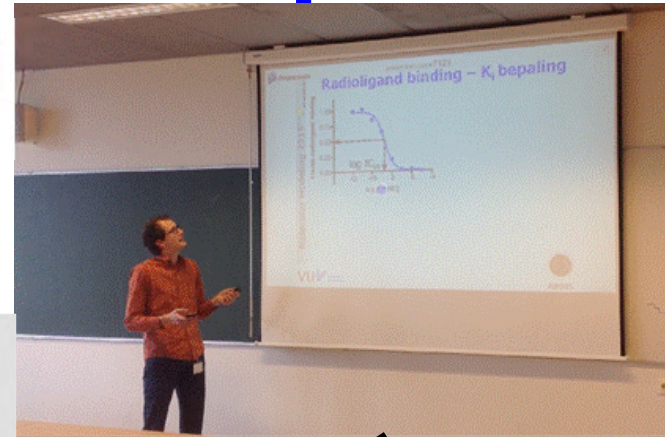
- **In week 1, students vote for 'live' & online lectures**
  - Think about course material early on
  - 'Co-owner' course





# Novel recording technique

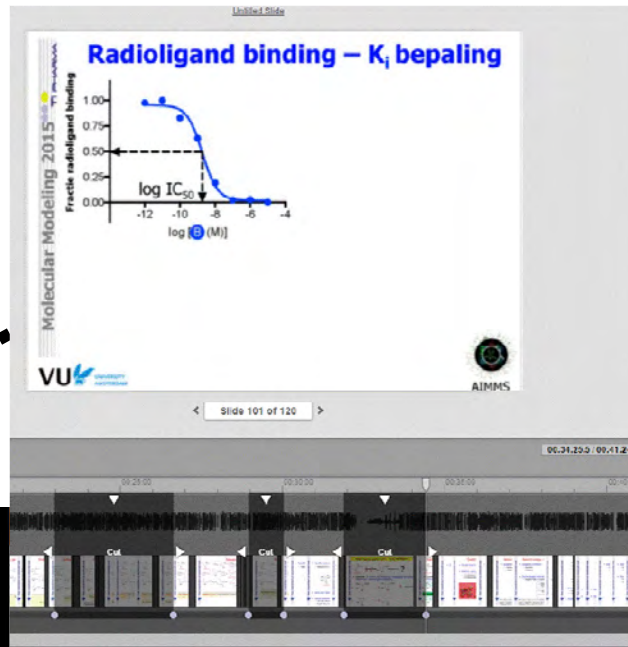
Presentain



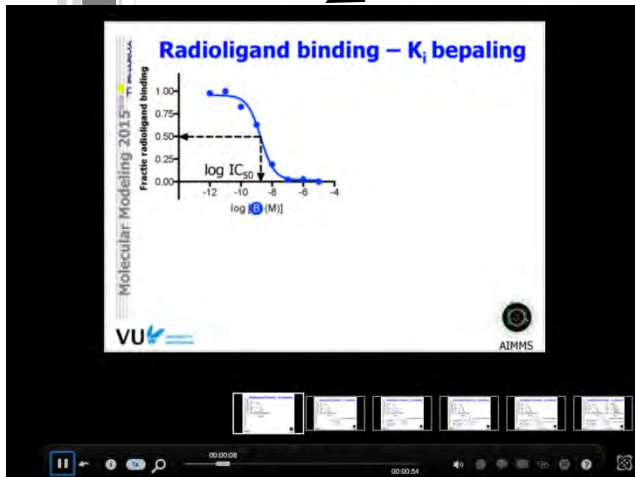
Extended Learning



Erik Boon

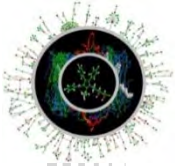


Automated workflows



Back-end statistics





# In-cast MC questions



Erik Boon



Verstuur Sla deze quiz over

Vraag 1: Drievoudig fosforzuur

**Drievoudig: fosforzuur**

$$\text{H}_3\text{PO}_4(\text{aq}) \xrightleftharpoons{K_{a1}} \text{H}^+(\text{aq}) + \text{H}_2\text{PO}_4^-(\text{aq})$$
$$\text{H}_2\text{PO}_4^-(\text{aq}) \xrightleftharpoons{K_{a2}} \text{H}^+(\text{aq}) + \text{HPO}_4^{2-}(\text{aq})$$
$$\text{HPO}_4^{2-}(\text{aq}) \xrightleftharpoons{K_{a3}} \text{H}^+(\text{aq}) + \text{PO}_4^{3-}(\text{aq})$$

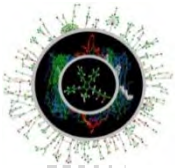
Vraag 1: hoe verhouden  $K_{a1}$ ,  $K_{a2}$  en  $K_{a3}$  zich, en wat is de reden?

a)  $K_{a1} < K_{a2} < K_{a3}$ : geconj. zuur steeds meer aanwezig  
b)  $K_{a1} < K_{a2} < K_{a3}$ : lading geconj. base steeds beter gestabiliseerd  
c)  $K_{a1} > K_{a2} > K_{a3}$ : geconj. zuur steeds minder aanwezig  
d)  $K_{a1} > K_{a2} > K_{a3}$ : lading geconj. base steeds slechter gestabiliseerd  
e) Ik weet het niet

a)  
 b)  
 c)  
 d)  
 e) Ik weet het niet

Back-end statistics

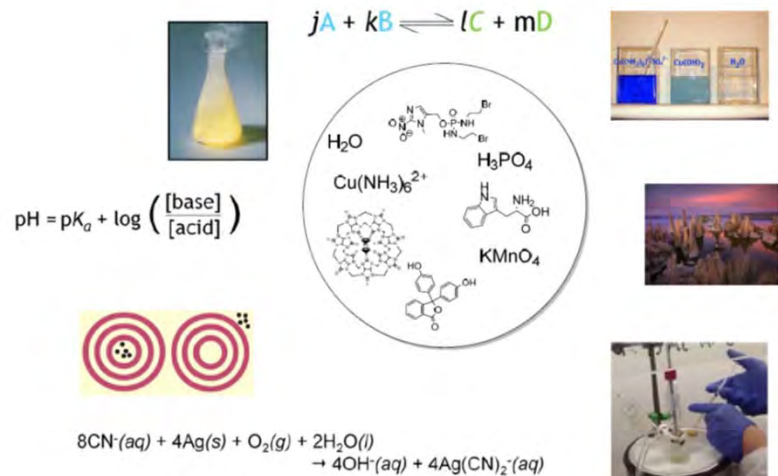




# The courses

- **General chemistry/Molecular Principles (MP)**
  - Already many aspects of active learning
  - **Start 2014: designing framework**

MP

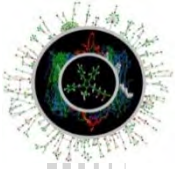


- **Cellular Biochemistry (CB)**

CB

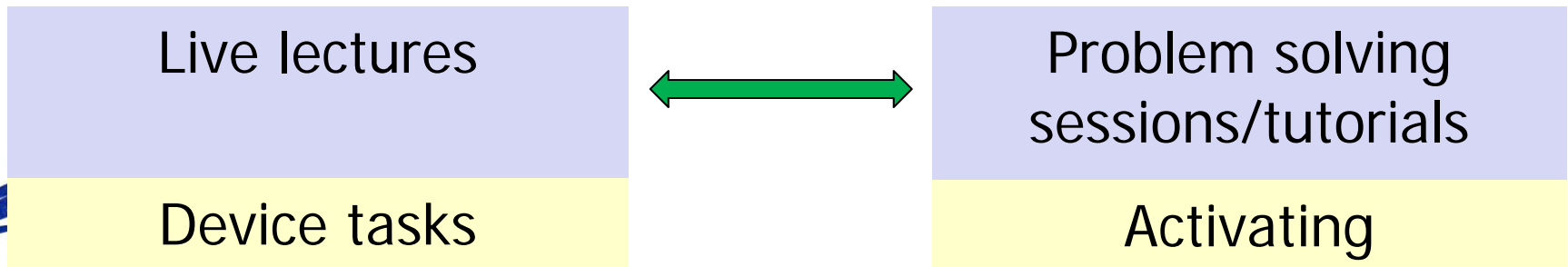
- Classical setup, but having problems
- **Start 2016: addressing problems, complete course overhaul**

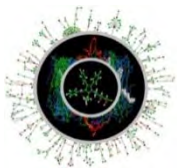




# MP: Stepwise trajectory

- -Sept '13: classical setup+activating components
- Sept '14: lectures recorded with phone (14 h)

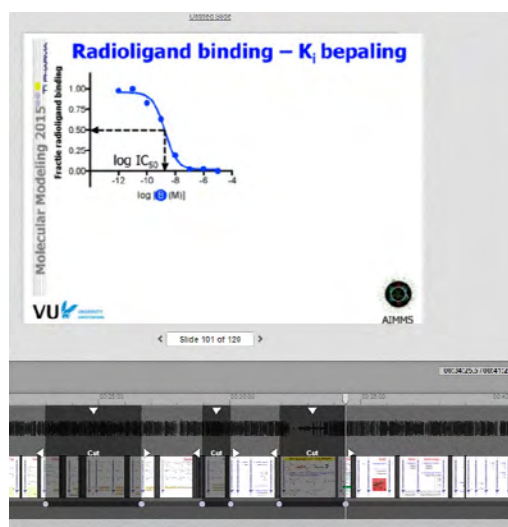




# MP: Stepwise trajectory

MP

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- Sept '15: casts edited



Live lectures

Device tasks

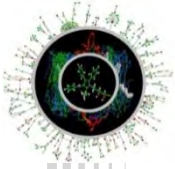


Problem solving sessions/tutorials

Activating

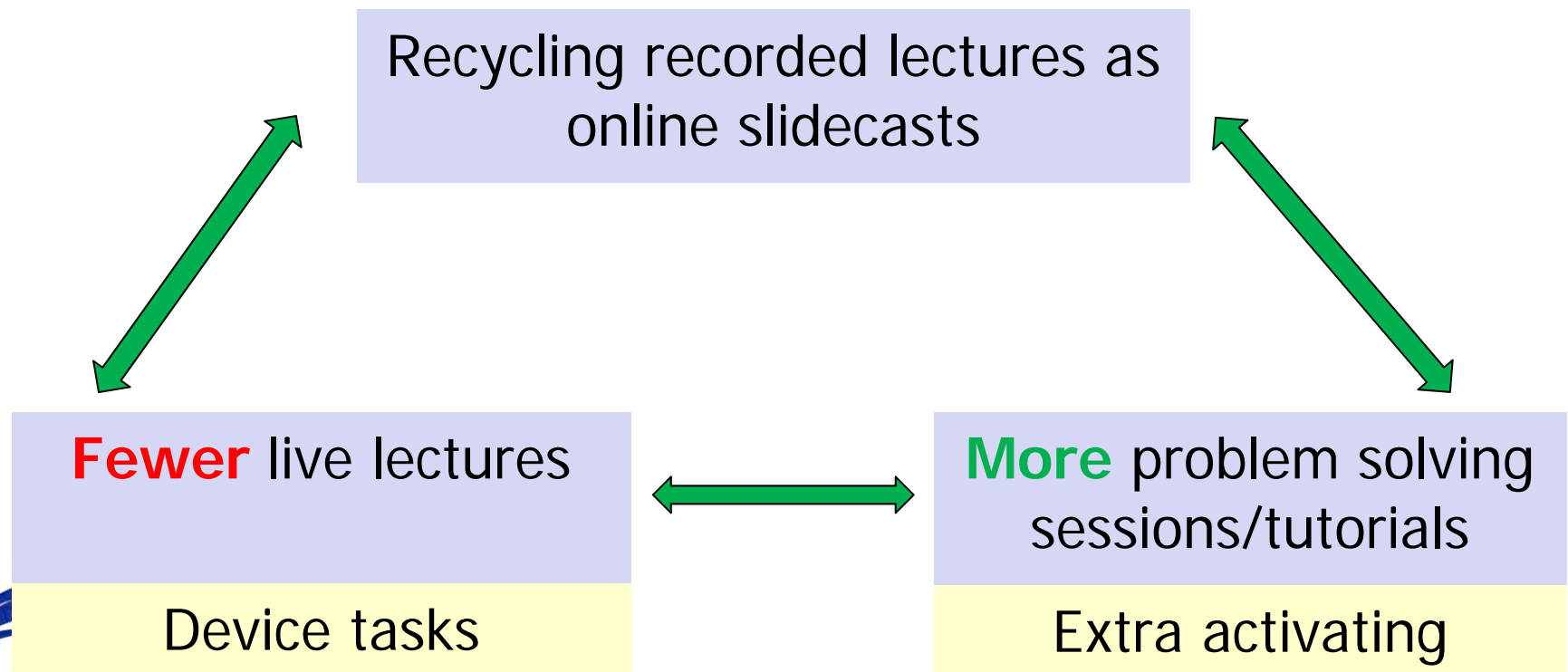


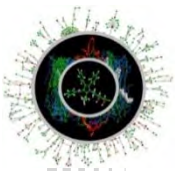
Blended Learning



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# MP: Stepwise trajectory

MP

- -Sept '13: classical setup+activating components
- Sept '14: lectures recorded with phone (14 h)
- Sept '15: casts edited, part online, students' vote
- Sept '16-'18: MC in slidecasts

Blended Learning



Recycling recorded lectures as  
online slidecasts

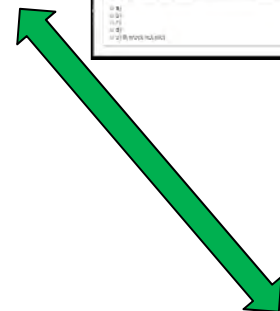
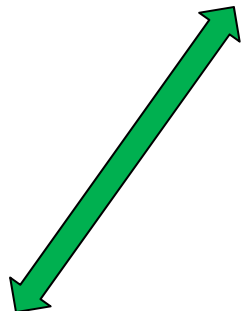
In-cast MC questions

**Fewer** live lectures

Device tasks

**More** problem solving  
sessions/tutorials

Extra activating



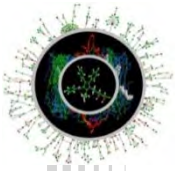


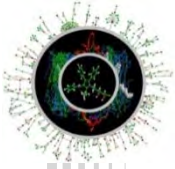
# General outcome

- Vote week 1 'live' & online lectures

	2018	2017	2016	2015
% voters	79	71	68	91

- Satisfactory electronic engagement
- Effect grade average
  - Small....
  - ...but persistent!





# Key evaluations students

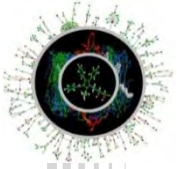
MP

- **Three or four years combined**

"The ability to choose the live lectures myself gave me a good overview of the course topics early on"	71% ✓	1% ✗
"The use of in-cast MC questions is a good way to keep attention"	92% ✓	0% ✗
"The Blended Learning approach stimulates me to be active with the course material"	88% ✓	4% ✗
"The Blended Learning approach has resulted in me better grasping the course material"	80% ✓	2% ✗
"The Blended Learning approach should be used next year again for this course"	92% ✓	2% ✗

Blended Learning

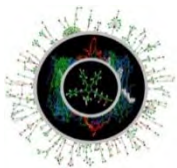




# CB: Addressing problems

- Low scores: perceived as difficult/many “details”
- Online MC questions largely ignored: no credit
- Joy of teachers reduced

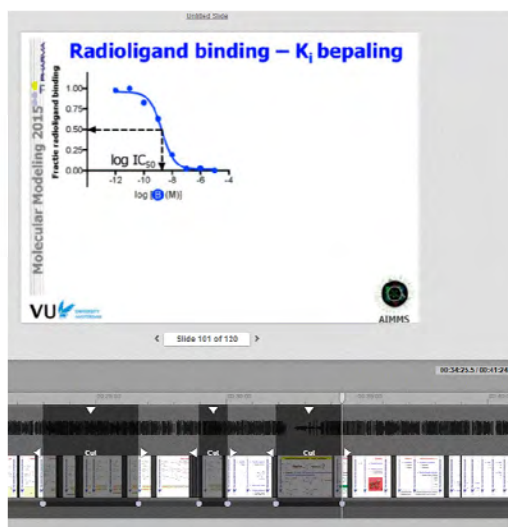




# CB: Trajectory

- -Sept '15: classical setup, no tutorials/device tasks
- Sept '16: lectures recorded, casts edited

Presentain

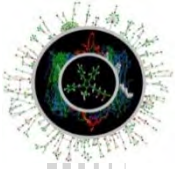


mediasite<sup>®</sup>  
by sonicfoundry

Blended Learning

Live lectures

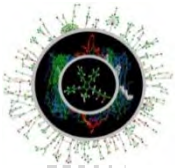




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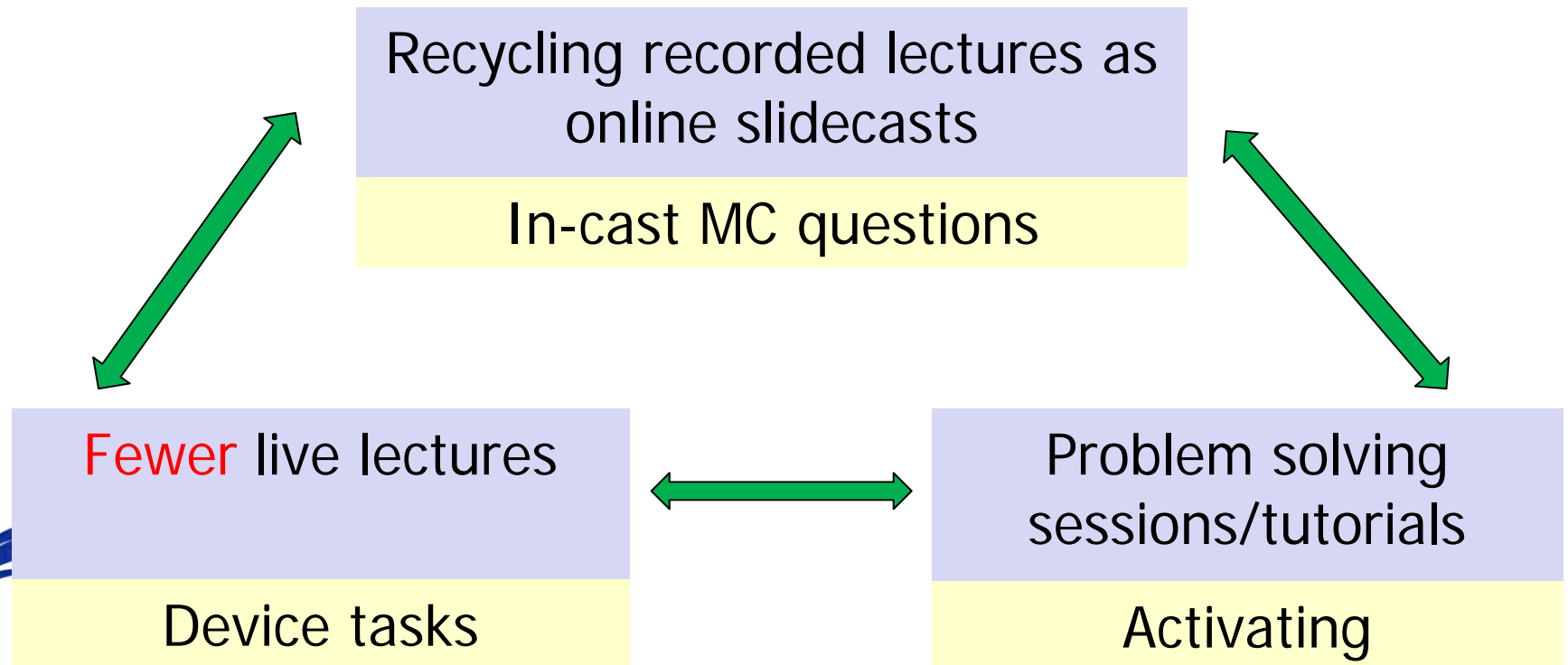
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  - Complete overhaul (no voting 1<sup>st</sup> week)

Live lectures



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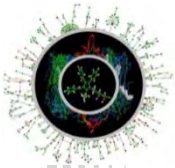
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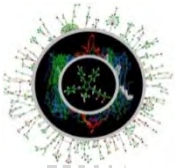


# General outcome

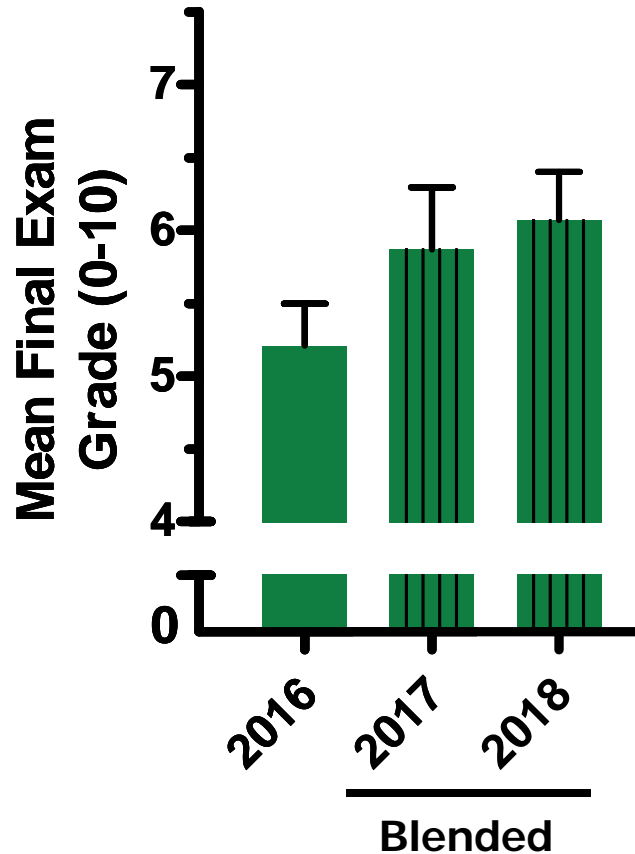
- Satisfactory electronic engagement
- Very good student evaluations

Next year again?	2018			2017		
In-cast MC questions	✓ 100%	✗ 0%		✓ 100%	✗ 0%	
Blended Learning	✓ 79 %	✗ 0%		✓ 94%	✗ 0%	





# Significant grade effect



### Cohen's d score:

2016 vs 2017: 0.50 (medium effect)

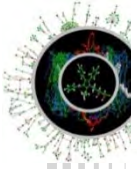
2016 vs 2018: 0.68 (medium/large effect)

### Review *meta*-analyses higher education:

Blended: average Cohen's d = 0.33

Longitudinal: novelty vs persistence





# Evaluations teachers

MP CB

- **MP and CB teachers combined**

The right tools & guidance lower any technical/mental barriers to record oneself

Technical support for editing and e.g. insertion of MC questions is crucial

BL more enjoyable than classical teaching format

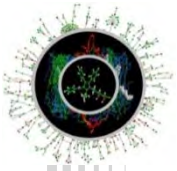
BL more effective in having students master class material

Communication to students about BL structure is key



# Conclusions

- **Recycling carefully designed lectures**
- **Technical innovations**
  - Recording lectures with a smartphone and transfer to MediaSite
  - In-cast MC questions
- **Blended learning in two bachelor courses**
- **General outcome**
  - Satisfactory electronic engagement
  - Students & teachers: positive
  - Significant grade effects



# Acknowledgments

## Collaboration

- All involved BSc students

## Support

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- Martine Smit
- Department
- Faculty

## VU innovation awards



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