# Future Curriculum

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# General trends

Towards

- applications

- integration with other disciplines

- cyber-physical systems

- security

# Flipped Classroom Teaching

# An Adequate Presence-Based Learning Approach in The Internet Age

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# Introduction

- Internet changed students' approach to learning

- Looking for information on the internet

- Focus on skills & ability to put into perspective

- How do we deal with this at universities?

  - Lectures: value compared to videos?

  - Use new media where useful!

  - Use presence of students to their advantage! ($\neq$ MOOCs)

  - Differentiate from online-courses!

# Introduction (2)

## Lectures Aren't Just Boring, They're Ineffective, Too, Study Finds

12 May 2014 3:00 pm | 71 Comments



http://news.sciencemag.org/education/2014/05/lectures-arent-just-boring-theyre-ineffective-too-study-finds

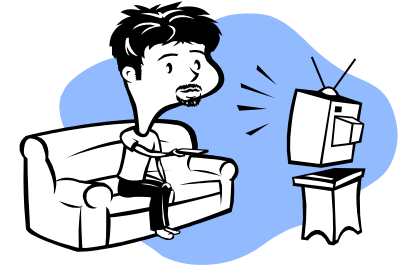**Future of universities if issues not addressed ??**

**This talk demonstrates the concepts of flipped classroom teaching, based on a course on CPS fundamentals.**

# Flipped classroom style using videos

No longer feasible to use traditional classroom teaching

- Students watch videos at home

- Physical presence is used
  to work on work sheets

- Home work and work in class are essentially flipped

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# The pros of flipped classroom teaching

- Higher quality of recorded videos

- Interactive learning

- Training for teamwork

- Taking advantage of students being present

- Students trained to apply concepts

- Re-discovery of the usefulness of books

- Early feedback for educator
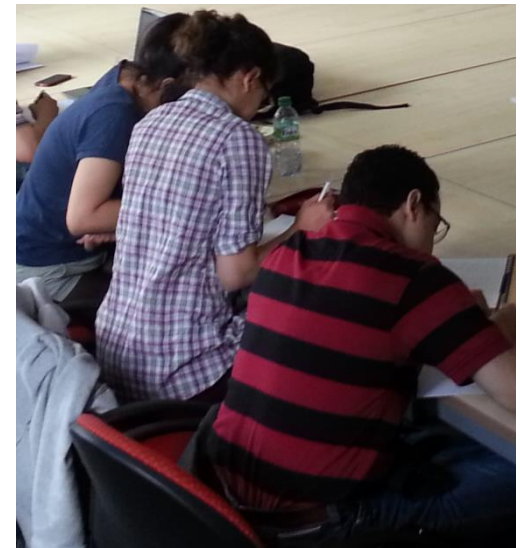
# Class meetings



- Really taking advantage of students being present

- Cooperation among students, team work

- Discussion in the class room

- Immediate feed back

- Preparing for the finals

- Preferably done by professor (and not by TA)

# Lab sessions

Previously at conflict

- Focus on practical training or on (theoretical) concepts?

Conflict resolved:

- Practical training only

Examples:



- LabView for Mindstorm robots

- Hierarchical state charts (incl. μcontroller)

- VHDL simulation

Scoring in lab sessions a pre-requisite for finals

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# Related work

- Project-based learning (e.g. at ALARI)
- Seminar style teaching in social sciences
- Practical training contains elements of flipped classrooms
- D. Black-Schaffer (Video and HIPEAC conference *in Tallinn*)
- Rutherford, R.H. & J.K.
- Lage, Platt et al.
- Loviscach: (German) video on youtube
- Keengwe et al., (Book), mention many disciplines
- Bergmann et al.: How to engage students
- Wikipedia (good article in this case)
- MOOCs: edX, Coursera, ..

Our experience: many similarities.
Distinction: limited effort, special instance: CPS

# Applicability

- Applies to many courses, not just CPS

- Not for freshmen

- Not for very large classes (> 120 students)

- Not for frequently changing content

- Not for a very interactive lecture.

- Needs videos (should be recording in an actual class)

- Best when labs can be re-designed to focus on application

- Still some benefit for traditional lectures and worksheet-based class meetings (labs, ☞ ALARI)

# Potential cons of flipped classroom teaching

- Effort for generating video

- Smaller rate of changes?

- Not applicable for all courses

- Too much focus on isolated skills?

- Dropping complex, difficult assignments?

- Potential attempts to replace professor by TA

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# Evaluation of our course on CPS fundamentals

- Attendance
  - constant at ~30 students in 2013
  - ~ 30 students in 2014
- Interactive atmosphere
- Increased use of the text book
- Very good student evaluation (in 2013)
  - No chance for falling asleep
  - 1 complaint about the amount of work: 4 hours of videos/week
- Good success in the finals in 2013
- Chopping videos into 20-30 min chunks was ok, shorter chunks not needed
- Self-checks not needed (saves much work)

# Conclusion

- Choice of learning methodology is affected by the Internet

  - focus on competences, availability of media

- Universities should take this change into account

- The flipped classroom  approach

  - is appropriate for presence-based learning

  - works for CPS-education, but also beyond

- Applicability

  - not for freshmen & changing topics

- Project-based learning at ALARI good

- Potential impact on lecture-style courses