Lectures flop, so flip the classroom

Gunnar Karlsson
School of Electrical Engineering
Imaginary view of teaching
Real view of teaching
Broadcasting problem – flow control and compatibility
Technology-enhanced learning

Your Own Private Socrates

Any point: Tradeoff of cost vs coaching

YOPS

MOOC

UDACITY

Iversity

Coursera

Future Learn

edX
Outline of remainder

• The case for active learning
• Peer instruction
• Flipped classroom
• Experiences at KTH
• Structure of a flipped course with peer instruction
• Learning management tool and learning analytics
• Active learning at distance and scale
• A proposal for an undergraduate MOOC College
• A reason why education must improve
• Conclusion
The case for active learning

Active learning increases student performance in science, engineering, and mathematics

Scott Freeman, Sarah L. Eddy, Miles McDonough, Michelle K. Smith, Nnadozie Okoroafor, Hannah Jordt, and Mary Pat Wenderoth

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Edited* by Bruce Alberts, University of California, San Francisco, CA, and approved April 15, 2014 (received for review October 8, 2013)

To test the hypothesis that lecturing maximizes learning and course performance, we metaanalyzed 225 studies that reported data on examination scores or failure rates when comparing student

225 studies in the published and unpublished literature. The active learning interventions varied widely in intensity and implementation, and included approaches as diverse as occasional group

“active learning leads to increases in examination performance that would **raise average grades by a half a letter**, and that **failure rates under traditional lecturing increase by 55%** over the rates observed under active learning.”
Peer instruction to activate the class

Peer Instruction: Ten years of experience and results
Catherine H. Crouch and Eric Mazur a)
Department of Physics, Harvard University, Cambridge, Massachusetts 02138
(Received 21 April 2000; accepted 15 March 2001)
We report data from ten years of teaching with Peer Instruction (PI) in the calculus- and algebra-based introductory physics courses for nonmajors; our results indicate increased student mastery of both conceptual reasoning and quantitative problem solving upon implementing PI. We

• Ask a question, let them think
  • Take answers by clickers, hands in the air, colored cards
  • Do not give any feedback
• Let students work two-by-two
  • New answer
• Compare the outcomes of the two rounds of answers and discuss the question
Using online material: Flipped classroom and peer instruction
Active learning at KTH

Flipped classroom and peer instruction
• Now used in courses in all five-year engineering programs
• Positive outcomes; no teacher who has tried wants to return to old practice
• Student resistance in the beginning; now they are used to active teaching and might demand it for all courses

Voluntary effort, bottom up
• Neither incentives nor pressure for teachers to change
• Peer pressure and student expectations might lead to wide-scale adoption
• A reward structure would be beneficial
• And time to restructure and develop a course
Structure of a course
Use of learning management system

Scalable learning, developed by SICS Swedish ICT

• Easy to provide videos to students
• Add multiple-choice and free-text questions
  • Machine graded
• Get individual student data on progress and difficulties
• Use any video material
  • eliminating need to provide own material
  • TED talks, OER, recorded television and film
Ring topology

- Point-to-point links
  - Between neighbors
- Signals rotate around the ring
- Advantages
  - Easy to install and reconfigure
- Cost

Disadvantages
- Robustness
- Dual ring for robustness and capacity
Insert a Video Question:

**On-video Quiz**
Place quiz choices on top of the video. Use this if the answers are visible in the video.
- One answer
- Multiple answers
- Drag and drop

**Text Quiz**
Text quiz on a white background. Use this if the quiz answers are not visible in the video.
- One answer
- Multiple answers
- Drag and drop
- Free text answer

**On-video Survey**
Surveys have no correct answer. Use this if the survey choices are visible in the video.
- One answer
- Multiple answers
### Course Progress: EP1100 - Select a Module

<table>
<thead>
<tr>
<th>Course Links</th>
<th>Course Introduction: Concepts, models and examples</th>
<th>Data Communication</th>
<th>LAN Standards</th>
<th>Lab Preparation Quizzes</th>
<th>Hints and solutions to extra problems</th>
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**Names of students**

- Student 1: Completed all sections within the time limits.
- Student 2: Completed all sections except Lab Preparation Quizzes.
- Student 3: Completed all sections except Data Communication and LAN Standards.
- Student 4: Completed all sections except Hints and solutions to extra problems.
Learning analytics

Useful data from learning management system
• Learn study habits of those who success and fail
• Early warning to those who run risk of failing
• Indications of deficient material and inherent difficulty
• Adapt in-class meetings to performance on preparatory material

Risks
• Sensitive with respect to personal integrity
  • Basically IQ tests run on large populations

Mitigation of risk
• Identifiable data only needed for student and teacher
• Random identifier for linking results across courses
Active learning at distance and scale

- KTH Summer Mathematics  www.sommarmatte.se
  - Online bridging course, nationwide
  - Started in 2005; 71 000 students to date
  - For credit, students obtain financial aid
  - Throughput 50 percent
- Current project at SICS Swedish ICT on professional distance education
  - Challenges
    - Scheduling and priorities
      - Work tasks, family, own time
    - Academic studies in the past
    - Work in progress, no results yet
- Peer instruction requires system support
  - To group students who are in phase
  - Provide protocol to follow; control of process
  - Produce material following exercise as feedback on the different alternative answers
- Clarity on structure, approach and purpose
  - Minimize structural uncertainty
  - …
Higher education and MOOCs

Georgia Tech MS in CS

MOOC

College

Examination

Financing

Admission
Organization for MOOC-based education

• Hard to be a student without context
  • no peer pressure, no support and no socializing
  • where to study, when and how?
• My proposal: The MOOC College
  • Organize studies
  • Activate students and
  • Life-long learning
• Study coaches
  • Individual study plan of MOOCs
  • Organize study groups with tutors
  • Add extracurricular activities
  • Examination and certification by external partners
THE FUTURE OF EMPLOYMENT: HOW SUSCEPTIBLE ARE JOBS TO COMPUTERISATION?

Carl Benedikt Frey† and Michael A. Osborne‡

September 17, 2013

Abstract

We examine how susceptible jobs are to computerisation. To assess this, we begin by implementing a novel methodology to estimate the probability of computerisation for 702 detailed occupations, using a Gaussian process classifier. Based on these estimates, we examine expected impacts of future computerisation on US labour market outcomes, with the primary objective of analysing the number of jobs at risk and the relationship between an occupation’s probability of computerisation, wages and educational attainment. According to our estimates, about 47 percent of total US employment is at risk. We further provide evidence that wages and educational attainment exhibit a strong negative relationship with an occupation’s probability of computerisation.

Keywords: Occupational Choice, Technological Change, Wage Inequality, Employment, Skill Demand

JEL Classification: E24, J24, J31, J62, O33.
A coming societal challenge

A new need
• Retraining, continuous development
• Staying ahead of the machines

Suggestions
• Less initial full-time study
  • too big investment of uncertain usefulness
• Blend work and studies throughout life
  • Studies adapted to present and future work
  • Suited to situation in life
    – for increased wellbeing
    – applicable skills and knowledge
• Re-certification of
  – acquired skills and knowledge
  – whenever needed
• Life-long service contract with place of learning
Conclusion

Teaching should be based on scientific knowledge
• Active learning provably superior to passive teaching
• Substantial improvements cannot be ignored

Flipped classroom with peer instruction works well
• Tested at scale at KTH in different subjects
• Simple default to get faculty started
• Open for experimentation by teachers

Learning management systems are useful
• Self-corrected quizzes
• Monitoring of individual progress
• Learning data for feedback to students and teachers alike

Distributed large-scale teaching require active learning
• Important to consider students’ learning situation and environment
• Socializing around learning
• Peer instruction possible at distance with appropriate system support
Conclusion

The age of automation increases the need for effective learning

- Skills and knowledge obsoleted by machines
- Recurrent retraining might be needed
- Large initial investment in studying might not pay off

Continuous learning for

- staying competitive vis-à-vis machines
- increased life quality and meaning
- orderly democratic society and optimism about the future
Thank you for your attention!

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