Why active teaching?
- A personal perspective

Christian Jørgensen
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Myers-Briggs personality types
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1-2 %
Improved Learning in a Large-Enrollment Physics Class

Louis Deslauriers,¹,² Ellen Schelew,² Carl Wieman*†‡

We compared the amounts of learning achieved using two different instructional approaches under controlled conditions. We measured the learning of a specific set of topics and objectives when taught by 3 hours of traditional lecture given by an experienced highly rated instructor and 3 hours of instruction given by a trained but inexperienced instructor using instruction based on research in cognitive psychology and physics education. The comparison was made between two large sections (N = 267 and N = 271) of an introductory undergraduate physics course. We found increased student attendance, higher engagement, and more than twice the learning in the section taught using research-based instruction.

Carl Wieman

University science professors preach a gospel of seeking truth through data and careful experimentation, yet when they walk into a classroom, they use methods that are outmoded and ineffective.”

Think like a researcher in the classroom too!

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Traditional lectures by the most popular teacher

Active learning methods by inexperienced postdoc

Make it stick
-The science of successful learning

“One of the most striking research findings is the power of active retrieval — **testing** — to strengthen memory”
Students prefer teaching methods that are comfortable but among the least productive.
System 1 – Intuition

- Monitoring, context.
- Multiple senses.
- **Suggests** solutions.
- Directs attention.

System 2 – Rationality

- Is logical, requires **thinking**.
- Energy-demanding, you feel **tired**.

Daniel Kahneman
A book and a pencil together cost $1.10. The book costs $1 more than the pencil. How much is the pencil?

Students at Princeton University, 3 tasks

• With clear print: 10% had all correct.
• With blurred print: 65% had all correct!

When reading is demanding the brain activates rationality, which rejected the wrong answer suggested by intuition. Cognitive load, regardless of origin, mobilizes rationality.
Movement across cell membranes

1. Describe which of the following methods of transport is best able to move the molecule described across the cell membrane:
   - Passive diffusion
   - Facilitated diffusion (channel protein, carrier protein)
   - Active transport

2. Draw a figure that demonstrates how the molecule moves across the membrane.

3. Explain the hydrophilic and hydrophobic regions of the membrane. How is the movement of the molecule that is moving across the membrane? Any proteins involved? Be sure that it is clear in your drawing, which side of the membrane has a greater and a lesser concentration of the molecule.
Active teaching can be simple

Common for many active teaching methods: students need to **generate** their knowledge.

Two easy forms for active teaching:

1. **Stop** lecturing ten minutes before you usually do.
2. Ask students to **write down** what they have learned.

1. **Show a diagram** you usually have in your lecture.
2. Have **students explain it** to each other rather than you do it.
Level 1. What the student is.
«Blame the student».
Level 2. What the teacher does.
«Blame the teacher».
Level 3. What the student does.

Analysis of modern higher education—challenges and solutions!
Its thinking underlies the Bologna process.

[If you have limited time, read the short version: John Biggs. 1999. What the student does: Teaching for enhanced learning. *Higher Education Research & Development* 18:57-75.]
Biggs SOLO taxonomy

Pre-structural

Uni-structural

Remember
Recognize
Do simple procedure

Multi-structural

Describe
Combine
List
Execute in sequence

Relational

Analyze
Apply
Discuss
Explain causes
Criticize
Compare

Extended Abstract

Generate
Hypothesize
Reflect
Create
Theorize
How to equip students with deeper understanding?

Wikipedia

- Remember
- Recognize
- Do simple procedure

- Describe
- Combine
- List
- Execute in sequence

Higher education

- Analyse
- Apply
- Discuss
- Explain causes
- Criticize
- Compare
- Generate
- Hypothesize
- Reflect
- Create
- Theorize

Pre-structural | Uni-structural | Multi-structural | Relational | Extended Abstract
Think, pair, share

1. **Ask** a question.
2. Tell students to **think** about it individually.
3. Make students **discuss** two and two.
4. **Share** insights in plenary.
Active teaching
Digital tools
Teacher: What activities make students master the learning outcomes?

Student: What do I need to learn to master the exam?

Will this be tested at the exam?

Biggs’ Method: Constructive Alignment

Teacher: Which forms for assessment will test the learning outcomes?

Student: By mastering the exam I fulfil the learning outcomes!
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An impossible ideal...

Solution: Concrete tricks with desirable effects.
Solution:
Concrete tricks with desirable effects.

Focus on content, not the lecturer.

«Researcher»

Turn rationality ON!
You are lucky!

- You *want* teaching.
- Talk together!
- Share ideas, plans, literature, mistakes...
- **Cooperate**: We do not compete with each other, but with Sweden, UK, and the rest of the world.