When active learning fails: How faculty beliefs and intentions inform their teaching and influence student outcomes

Harvard Medical School
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Stanley M. Lo
University of California San Diego
Warm-up question: What is active learning?

Which one of the following scenarios best describes active learning?

a. Flipped course with video lectures before class
b. Independent research in faculty laboratories
c. Laboratory course with hands-on experiments
d. Lecture course with clicker questions in class
e. Seminar course with discussions of primary literature
An experiment on active learning

Introductory physics with 250+ students

Control

Experimental

Lecture

Lecture

Active learning

Week 12

Test

Effect size = \frac{\text{Exp} - \text{Control}}{\text{SD}_{\text{Control}}}
Evidence: Active learning improves student outcomes

**General meta-analyses**
- Science (2011) 331: 1269-1270

**Disciplines: Chemistry and engineering**

**Methods: Problem-based learning**

Calls for change in undergraduate education


Active learning not always correlated with student outcomes

- 33 instructors and biology courses
- Pre/post assessment on evolution concepts

Effect size (ES) = \[
\frac{\text{Post} - \text{Pre}}{\text{SD}_{\text{Pre}}}
\]

From K-12 literature
- Science Education (2003) 87: 564-573
Discipline-based education research (DBER)

Intervention-based research
- Examines effectiveness of specific programs and instructional methods
- The “what” and the “how”

Basic research
- Investigates underlying mechanisms for teaching and learning
- The “how” and the “why”

National Research Council (2012) Discipline-Based Education Research
Case studies on faculty teaching and student outcomes

**Case study**: In-depth examination of distinct, single instances of a phenomenon
- Unusual cases to probe problematic situations (case study 1)
- Maximum variation to explore a range of different settings (case study 2)

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**Case study 1**: Two instructors

- Student outcomes
- Faculty teaching

**Case study 2**: Three instructors
Case study 1: Connecting faculty teaching and student outcomes

Two sections of an Intro Bio course with 250-300 students per section
- Developed collaboratively by two instructors
- Included active learning: clicker questions and group activities
- Common syllabi, lecture slides, learning materials, exams
- Similar students: Equivalent cumulative GPA, SAT, demographics
- Similar time of day: MWF 10 am vs MWF 11 am
- Same physical space: lecture room with stadium seating

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### Classroom Observation Protocol for Undergraduate STEM (COPUS)

- Record instructor and student actions in 2-min intervals

#### Instructor actions
- Lecturing
- Posing question
- Answering question
- Extended discussion
- Clicker question
- Follow-up information
- Moving in groups
- Waiting

#### Student actions
- Listening
- Asking question
- Answering question
- Thinking individually
- Clicker discussion
- Group work
- Whole-class discussion
- Presentation

Smith et al (2013) CBE Life Sciences Education 12: 618-627
Why they were different: Semi-structured interviews

Interview questions
• In general, how would you define teaching?
• What does teaching mean to you?
• What would you describe as your ideal teaching situation?
• What are the key components of teaching?
• What makes a good teacher?

Data collection and analysis
• Two interviews out of larger data set (16 total interviews)
• Transcribed verbatim and blinded
• Analyzed using existing framework
• Two independent raters: 88% agreement

Conception, approach, and practice of teaching

Conception
• Attitudes and beliefs
• The “why”

Approach
• Intentions and strategies
• The “how”

Practice
• Actions and behaviors
• The “what”
Strips organization: What are different conceptions of teaching?

**Conceptions of teaching:** Combination of attitudes and beliefs about teaching, what someone sees as the purpose of teaching, the “why” of teaching

“Sometimes you have to not push them through it but lead them through the forest a couple of steps ahead the first time. (...) You’re guiding them. (...) And then the hope is that they do this and learn from that. But then they have to be able to try to go through the forest on their own (…)”

“Fundamentally, [teaching is] changing someone’s understanding of the world by making it deeper and in-line with the scholarship of what is rigorously true according to our scientific methods.”

“[I]t’s about learning how to solve their own problems or the problems they encounter, so teaching for me is enablement. (...) Enabling an individual to encounter new problems and self-solve them. That’s teaching to me.”

“But it’s not that important for you to understand how those facts were arrived at or those systems were developed. You just need to learn them. And in that case I think it’s important for people to be presented with those systems.”

“I provide them with all of the basic information that they need to learn the material, and there are many complaints because they say the exams are at a much higher level, but that’s their job.”

“[Y]ou can’t really teach people. You can facilitate that, but they have to do it. And so I see my place as more of a facilitator now. (...) I would want them (...) to still remember the core principles that were taught in the course...”

Arrange excerpts into different conceptions of teaching based on any categorization.
"[I]t’s about learning how to solve their own problems or the problems they encounter, so teaching for me is enablement. (...) Enabling an individual to encounter new problems and self-solve them. That’s teaching to me.”
Conception
• Attitudes and beliefs
• The “why”

Approach
• Intentions and strategies
• The “how”

Practice
• Actions and behaviors
• The “what”

Existing model in literature

Our current hypothesis
Case studies on faculty teaching and student outcomes

**Case study**: In-depth examination of distinct, single instances of a phenomenon

- Unusual cases to probe problematic situations (case study 1)
- Maximum variation to explore a range of different settings (case study 2)

**Case study 1: Two instructors**

- **Student outcomes**
- **Faculty teaching**

**Case study 2: Three instructors**

Case study 2: Dissecting faculty teaching

- Three different Intro Bio courses with 200-300 students
- Active-learning approaches: clicker questions and group activities

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Our current model: What makes active learning effective?

Key to effective implementation

Best practice:
Teaching as technique or recipe

Reflective practice:
Teaching as science or methodology

Approach

Explicit

Conception

Implicit
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