

# Evidence-based teaching: how do we all get there?

Guided Discussion

AMS Committee on Education

Joint Mathematics Meetings 2019

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(handout available at [web.nmsu.edu/~davidp](http://web.nmsu.edu/~davidp))

(if you'd like to continue the conversation, join

<https://lists.uoregon.edu/mailman/listinfo/active-math>)

## Givens today

- 2014: NSF press release "Enough with the lecturing"
- 2016: CBMS Statement on Active Learning
- 2017: MAA Instructional Practices Guide

## 2016: CBMS Statement on Active Learning

- "We call on institutions of higher education, mathematics departments and the mathematics faculty, public policy-makers, and funding agencies to invest time and resources to ensure that effective active learning is incorporated into post-secondary mathematics classrooms."
- Definition of active learning: "Classroom environments in which students are provided opportunities to engage in mathematical investigation, communication, and group problem-solving, while also receiving feedback on their work from both experts and peers" and "classroom practices that engage students in activities, such as reading, writing, discussion, or problem solving, that promote higher-order thinking."

## Some steps to "getting there"

1. training graduate students and early career mathematicians
2. developing departmental experts who can lead and mentor
3. offering wide-scale programming for department chairs
4. updating inventory tools of teaching practices for observations and training
5. shifting program evaluation towards active learning and deeper, more authentic learning outcomes

## And some challenges

6. large lectures, and the challenges they present for interaction, including individual feedback, group work, and whole-class discussion
7. dissemination of teaching materials currently biased towards lecture format
8. culture, inertia, and incentive systems

## Question 1.

- What would you most like to see happen soon in your department and institution toward widespread adoption of active learning pedagogy?
  
- What would you personally most like to do or work on toward adoption of active learning pedagogy?  
(This must be more broad than your own practice - a goal should involve colleagues, say those who teach a particular course. We encourage ambition - every course should in fact be taught with evidence-based pedagogy. Though if your goal is “everything”, we ask you to name a highest priority (or two).)

A - We will very shortly be surveying everyone to gauge interest in each topic, and will record rough estimates so we can best support discussions relevant to audience interests.

B - We will then go through topic-by-topic and ask our leaders to volunteer which topic they will support in their circle, also writing it down by number on both sides of a card we've provided. As they announce their topic they may, if they wish, share a sentence or two about aspects of their experience.

C - We will play "musical chairs" as the leaders hold up their cards: we ask you all to move, if necessary, to the discussion circle of a leader who is addressing a topic of interest to you!

## Question 2.

- What are the steps you see and main challenges you and your colleagues would need to overcome in order to achieve what you identified in Question 1?

### Question 3.

- What are existing resources and models which you can build on?
- What do they help address and what do they leave open from the steps and challenges you identified in Question 2?
- How do you see using them in your plan to achieve your goals from Question 1?

#### Question 4.

- What do you feel is needed (not covered by what you found in Question 3) locally, regionally, or nationally, in order to support what you would like to do or see happen?
- In particular, what kind of curricular or training materials or other supports (e.g., clear recommendations to administrators) would you like to see developed nationally?
- And what kinds of professional networks would you like to have available so that you can share experiences and insights with others in similar contexts and/or having similar goals, as you engage in this work?

Think big... make small(er) immediate plans

Example: new publishing models and systems for pedagogical materials including worksheets, think-pair-share questions, applets, discussion of areas of difficulty and common students responses and plans for addressing them, and other materials which support active learning, along with textbooks, which combines features of the arXiv, MathReviews, MathOverflow, Curated Courses & UTMOST, Webwork, COMINDS training materials site...

Financed by course fees, with AMS/MAA as fiscal intermediary (new financial model), keeping more money in the community and saving students money.

In the meantime... more robust, high-profile blog networks (#MTBoS) where people share key experiences and favorite materials and approaches.

Think big... make small(er) immediate plans

Example: small, working communities of practice in both research and teaching. On the research side, looks like Women In... model of collaborative work on an expert-chosen problem and/or REUF. But also have pedagogy leader(s) to also focus on producing some materials (worksheets, texts, applets, discussions of practice) addressing a problem of pedagogical practice as well.

In the meantime... common practice to have a pedagogical session as part of research conferences, especially graduate training conferences.

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## Resources

- NSF press release *Enough with the lecturing* (2014)
- CBMS statement *Active Learning in Post-Secondary Mathematics Education* (2016)
- National Research Council: *Reaching Students: What Research Says About Effective Instruction in Undergraduate Science and Engineering* (2015)
- MAA Instructional Practices Guide (2017)
- Guidelines for Assessment and Instruction in Statistics Education (GAISE) (2016)
- MIT Electronic Seminar on Mathematics Education
- AMS Blog on Teaching and Learning Mathematics
- College Mathematics Instructor Development Source (CoMInDS), MAA

- Project NExT (New Experiences in Teaching), MAA; & Project ACCESS, AMATYC
- Undergraduate STEM Education Initiative, AAU
- Student Engagement in Mathematics through an Institutional Network for Active Learning (SEMINAL), APLU
- Academy of Inquiry Based Learning
- Journal of Inquiry-Based Learning in Mathematics
- Initiative for Mathematics Learning by Inquiry (MLI)
- IBL Special Interest Group of the MAA
- Transforming Post-Secondary Education in Mathematics (TPSE Math)
- Process Oriented Guided Inquiry Learning (POGIL)

- Innovative Teaching Exchange, MAA
- Innovations in College-Level Mathematics Teaching, AMS
- Learning Assistant Alliance; & Learning Assistant Program (UC Boulder)
- Accelerating Systemic Change Network (ASCN)
- NSF Division of Undergraduate Education
- MAA Progress Through Calculus studies
- AMATYC Webinar series
- Center for the Integration of Research, Teaching, and Learning
- Active learning resources from David Pengelley:  
<https://web.nmsu.edu/~davidp/>

- Active learning resources from Robin Pemantle, including pedagogical tips, and materials for calculus and teacher preparation courses:  
<https://www.math.upenn.edu/~pemantle/Active-resources.html>
- Active learning course materials from Matt Boelkins, Steve Schlicker, and Ted Sundstrom, for courses in  
Active Calculus (single and multivariable):  
<https://activecalculus.org/>  
Active Preparation for Calculus: <https://gvsu.edu/s/0Ui>  
Mathematical Reasoning: Writing and Proof:  
<https://scholarworks.gvsu.edu/books/9/>