

Week 5: Active Learning

Review of Online Module

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Learning goals of the online module

1. Describe how and why students benefit from active learning. Describe a model for the cognitive framework behind active learning.
2. Describe the importance of critical thinking and identify in-class approaches that advance critical thinking
3. Describe how teamwork can enhance active learning and lead students to uncovering information in class.
4. Experience examples of assessment for active learning

Description of main activities of online module

Online Videos

- **5.1.1:** An Introduction to Active Learning [06:12] – Dr. Katherine Spilios from Boston University provides an introduction to the Module with a short overview of active learning.
- **5.1.2:** The Cognitive Framework Behind Active Learning [05:20] – Dr. Katherine Spilios from Boston University provides a discussion of cognitive framework for active learning based on the work of Michelene Chi, mapping from passive, to active, to constructive to interactive learning in the classroom.
- **5.2.1:** Principles of Critical Thinking [7:14] – Based on the work of the National Council on Excellence in Critical Thinking, Dr. Bennett Goldberg from Boston University describes how critical thinking frames inquiry-based labs, the cycle of scientific inquiry and team, and project-based learning
- **5.2.2:** Introduction to Problem Based Learning [02:23] – Dr. Rique Campa from Michigan State University introduces the cycle of inquiry that underlies problem-based learning.
- **5.2.3:** The PBL Process [02:21] – Dr. Rique Campa from Michigan State University discusses the key steps in problem-based learning.
- **5.2.4:** Example of Inquiry-Based Labs in Intro Astronomy [04:24] – Dr. Cynthia Brame from Vanderbilt University shows an example of an Inquiry-based lab in astronomy and analyzes the components.
- **5.2.5:** Principles and Definitions of Inquiry-Based Labs [04:37] – Dr. Cynthia Brame from Vanderbilt University gives an overview of the key steps in creating and implementing inquiry-based labs.
- **5.3.1:** Introduction to Cooperative Learning [03:59] – Dr. Rique Campa from Michigan State University defines cooperative learning as when students work together to analyze, solve, interpret, or synthesize knowledge/problems.
- **5.3.2:** Incorporating Active Learning in Your Classroom [07:06] – Dr. Bennett Goldberg from Boston University provides a brief introduction that shows several ways to implement

cooperative learning in the classroom.

- 5.3.3: Examples of Active Learning [05:20] – Three short examples of peer instruction. Shot in classrooms at Harvard, Boston University, and Colorado Boulder, these examples show peer instruction in action.
- 5.3.4: The Best Questions to Ask [02:09] – Dr. Eric Mazur from Harvard University discusses what makes the best clicker or concept questions.
- 5.3.5: Overcoming Barriers to Implementing Peer Instruction [02:19] – Dr. Peter Newbury from University of California San Diego discusses faculty challenges to overcoming implementing peer instruction and suggests several solutions.
- 5.4.1: Measuring Active Learning in Classrooms [09:18] – Dr. Marco Molinaro from the University of California Davis and Dr. Bennett Goldberg from Boston University provide an introduction to how to measure the amount and type of active learning in classrooms using a simple, online tool called the Generalized Observation and Reflection Platform or GORP.
- 5.4.2: Implementation GORP on campus [03:46] – Dr. Marco Molinaro from the University of California Davis and Dr. Nicholas Gross from Boston University discuss the challenges to implementing GORP in the classroom.
- 5.4.3: Group Testing to Enhance Collaborative Learning [04:30] – Dr. Katherine Spilios from Boston University interviews student and faculty from Boston University, eliciting their perspectives on group testing.

Online Discussion Questions

- Discussion forum: Self-report in one of these two discussion boards: "Describe your experience with active learning as a student" or "What are your worries about Active Learning as an instructor"
- Discussion forum: Describe the active learning approaches used in problem-based learning. Provide examples either from your experience or from thinking about how to remodel a traditional class unit with PBL.
- Discussion forum: Describe the active learning approaches used in inquiry-based learning. Provide examples either from your experience or from thinking about how to remodel a traditional laboratory unit with IBL
- Discussion forum: Self-report in one of these two discussion boards: "Describe your experiences as a student with peer instruction, or "Discuss concerns about implementing peer instruction."
- Discussion forum: Choose one active learning method and develop a list of characteristics that you might choose to record as part of an in-class observational protocol. Think of the list as the buttons in a GORP protocol for measuring the particular approach to active learning you choose. Post in the appropriate thread.

Online Readings

- Read: Freeman et al. 2014. Active learning increases student performance in science, engineering, and math. PNAS.

An Introduction to Evidence-Based Undergraduate STEM Teaching, Fall 2015
Facilitator Guide to Accompany the MOOC-Centered Learning Communities

- Read: Lund, et al, CBE Life Sciences, Vol. 14, 1–12, Summer 2015, DOI:10.1187/cbe.14-10-0168 [Supplemental]
- Read: Examinations that Support Collaborative Learning: The Student' Perspective. Rieger and Heiner, 2014, JCST

Week 5: Active Learning

Activities for the MCLC In-person Sessions

Learning goals for MSLC in-person sessions

Depending on the direction the facilitator wishes to take the in-person session, the learning goals could include:

1. Refining and deepening your understanding of the four approaches to active learning (problem-based learning, inquiry-based labs, peer instruction, and cooperative learning).
2. Design and evaluate simple active learning activities.
3. Adapt group testing to participants' teaching experiences.

	Student Activity/Discussion	Facilitator Notes
Warm-up	Small group discussion than share out: what are your personal experiences with active learning? Positive/negative? As student or instructor?	This could potentially be a lengthy discussion since most participants will have something to share.
Activity #1	Analysis of the data: show Figure 2 from Freeman and ask participants to discuss discipline-specific challenges to implementing active learning.	
Activity #2	Divide class into 4 groups, and have each arrive at a consensus definition and three (or more) key characteristics of one of the 4 approaches to active learning (PBL, IBL, PI, CL) and then share out.	If you have a large class, there can be multiple groups working on each approach. You can expand the characteristics to include the key steps in an active learning approach.
Activity #3	Have small groups design an active learning classroom activity for a particular approach, and then share out. Have them start with the learning goal, have an idea of the assessment, and then build the active learning approach (backward design).	Depending on your class, pick one topic and have all 4 groups use the same topic, or have each group select their own discipline-specific topic. Each group should write a summary so it can be passed to another group.
Activity #4	Ask students to map the example active learning approach they designed in activity #3 above onto the characteristics, overt activities, and cognitive processes discussed in table 2 from Chi (2009).	Use the activities designed above for this step. Each group can trade activities to evaluate and analyze.
Activity #5	Adapting group testing to your teaching experiences: Ask students to work in groups and discuss a plan for how group testing might be used in one of their classes. Have them report out on how they would implement group testing, what value would it bring, and what pitfalls might be avoided.	