University of Michigan
Provost's Teaching Innovation Prize

2014 WINNER

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Dropping Lecture and Summative Exams to Accelerate Deep Learning

Innovation Description

Picture a section of 60 engineering students working in 12 groups, each with its own whiteboard. Prior to class, everyone has carefully read the assigned text and marked it up with social annotation software developed at MIT. After individuals bring homework solutions to class, each group strives for up to 90 minutes to create a superior, collective response. Almost as much time is then spent analyzing differences between the best solution and one's initial effort: distinguishing conceptual from procedural errors, rating overall understanding, listing areas that need review, and assessing other group members. Grades reflect working really hard and being honest about effort, rather than punishing mistakes.

No one is checking Facebook, and the room is buzzing with energy. When groups hit a roadblock, they appreciate quick and direct access to an instructional aide (an undergraduate who recently took the course), a graduate student instructor, or the professor.

This course, MSE 220, *Introduction to Materials and Manufacturing*, is open for any U-M faculty to visit, just as Yalisove was able to learn about these pedagogies through multiple visits to the Harvard physics classroom of Eric Mazur, the founder of Peer Instruction.

In 2015, this course will be scaled up for 200+ students by holding it in the newly renovated Pierpont Commons cafeteria.

Student Comments

"Despite the work required to complete challenging homework assignments and excel on our detailed group projects, the course was immensely enjoyable and fulfilling."

"Prior to this course, I focused only on the final grade, rather than the process of learning."

"Removing the exam-centric approach to learning was conducive to a more unprejudiced and eager pursuit of knowledge."

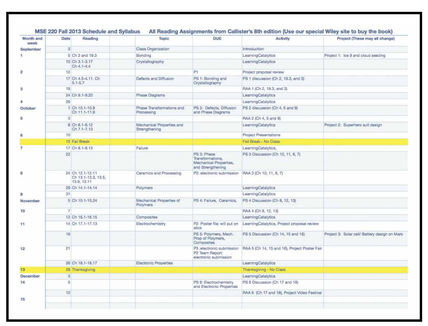
"The structure of MSE 220 gave me the opportunity to work with the teaching staff and the students at a far deeper level than any course I had taken before."

"Completing these homework problems, you always learned the applications of the concepts from the reading, and you learned the value of working collectively to solve complex problems."

"Group projects facilitated critical applications and extensions of course concepts to contemporary engineering problems. For example, our final group project was to design a solar farm on Mars that accounted for the harsh conditions of the Martian environment."

"I have implemented the practice of proactive learning in my other courses."

Examples of Teaching Innovation



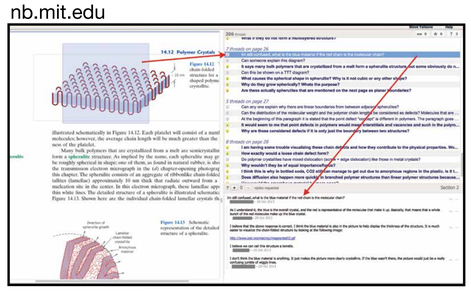
MSE 220 Fall 2013 Schedule and Syllabus — All Reading Assignments from Callister's 8th edition (Use our special Wiley site to buy the book)

Month and week	Date	Reading	Topic	DUE	Activity	Project (These may all change)
September 1	5		Class Organization		Introduction	
	7	Ch 2 and 19.3	Bonding		LearningCatalytics	Project 1: ice 9 and cloud seeding
	10	Ch 3.1-3.17 Ch 4.1-4.4	Crystallography		LearningCatalytics	
2	12			PI	Project proposal review	
	14	Ch 4.5-4.11; Ch 5.1-5.3	Defects and Diffusion	PS 1: Bonding and Crystallography	PS 1 discussion (Ch 2, 19.3, and 3)	
3	17				LearningCatalytics	
	19	Ch 9.1-9.20	Phase Diagrams		WAA 1 (Ch 3, 19.3, and 3)	
4	21				LearningCatalytics	
October 5	24	Ch 10.1-10.8 Ch 11.1-11.8	Phase Transformations and Processing	PS 2: Defects, Diffusion and Phase Diagrams	LearningCatalytics PS 2 discussion (Ch 4, 5 and 9)	
	26				WAA 2 (Ch 4, 5 and 9)	
6	28	Ch 6.1-6.12 Ch 7.1-7.15	Mechanical Properties and Strengthening		LearningCatalytics	Project 2: Superhero suit design
	31				Project Presentations	
7	2	Fall Break			Fall Break - No Class	
	5	Ch 8.1-8.13	Failure		LearningCatalytics,	
	7			PS 3: Phase Transformations, Mechanical Properties, and Strengthening PS: electronic submission	PS 3 Discussion (Ch 10, 11, 6, 7)	
8	9	Ch 12.1-12.11 Ch 13.1-13.5, 13.9, 13.10	Ceramics and Processing		WAA 3 (Ch 10, 11, 6, 7)	
	12	Ch 14.1-14.14	Polymers		LearningCatalytics	
9	14				LearningCatalytics	
November	16	Ch 15.1-15.24	Mechanical Properties of Polymers	PS 4: Failure, Ceramics,	PS 4 Discussion (Ch 8, 12, 13)	
10	19				WAA 4 (Ch 8, 12, 13)	
	21	Ch 16.1-16.10	Composites		LearningCatalytics	
11	23	Ch 17.1-17.13	Electrochemistry	PZ: Poster file will put on okta	LearningCatalytics, Project proposal review	
	26			PS 5: Polymers, Mech. Properties, Composites PS: electronic submission	PS 5 Discussion (Ch 14, 15 and 16)	Project 3: Solar cell/ Battery design on Mars
12	28			PS: electronic submission	WAA 5 (Ch 14, 15 and 16), Project Poster Fair	
	30	Ch 18.1-18.17	Electronic Properties		LearningCatalytics	
13	2	Thanksgiving			Thanksgiving - No Class	
December 14	5				LearningCatalytics	
	7			PS 6: Electrochemistry and Electronic Properties	PS 6 Discussion (Ch 17 and 18)	
15	10				WAA 6 (Ch 17 and 18), Project Video Festival	

MSE220 syllabus from fall 2013.

Unlike the tiered seating typical of lectures, a flat room with tables and whiteboards allows instructors to circulate easily among small groups.

nb.mit.edu



Students annotate readings and answer each other's questions using nb.