

Syllabus: E 110, Principles of University Teaching and Learning in STEM

Fall Quarter, 2017. 3 units. No Prerequisites. *This course is a required component of the Caltech Project for Effective Teaching (CPET) Certificate of Practice in University Teaching*

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Class Time: **Organizational Meeting and First Class: Tues., Sept. 26, 9:00-10:30 AM**
At the organizational meeting, we will determine the regular weekly class time.
Center for Teaching, Learning, & Outreach (same location as office)

Office Hours: Flexible; please e-mail or call to set up.

Website: Class website is in Moodle, <http://moodle.caltech.edu>, also linked through access.caltech.edu. E110 under “E (FA 2017)”; enrollment key “horii”.

Catalog Description:

Research on university-level teaching and learning in Science, Technology, Engineering, and Mathematics (STEM) disciplines has progressed rapidly in recent years; a well-established body of evidence-based principles now exists to inform instructors and students at the undergraduate and graduate levels. Increasingly, future PIs and faculty are called upon to demonstrate knowledge of and ability to apply established pedagogical and assessment practices, as well as to analyze the efficacy of new approaches.

In this course, weekly interactive meetings will provide focused overviews and guided application of key pedagogical research, such as prior knowledge and misconceptions, novice-expert differences, and cognitive development as applied to university teaching. We will also explore emerging university teaching and learning practices and their theoretical basis (e.g., the flipped classroom, online learning). Readings will inform in-class work and students will apply principles to a project of their choice.

Welcome to E110!

This course is designed to enable you to achieve the following **learning outcomes**:

- Identify and explain central research findings on university STEM teaching and learning.
- Apply findings to relevant courses and disciplines.
- Construct a comprehensive, current, and individually meaningful philosophy of effective university-level STEM teaching and learning.
- Value and practice evidence-based teaching and learning approaches.

In addition, E110 will address your **individual interests and outcomes** through an independent project and “Emerging Topics” class sessions. Together, our shared outcomes plus your individual work should **prepare you to be an effective, articulate, and self-directed university instructor and advanced life-long learner**, whether in academia or in similar settings.

Course Components:

- **Weekly Coursework & Participation:** As a 3-unit pass-fail course, shaped in part by your participation, your **contributions in class** are essential. ***Weekly pre-class coursework & in-class participation will contribute 50% of your course grade.*** Most weeks, you'll have the opportunity to **choose selections from readings that interest you:** e.g., a chapter in one of our **core texts**, *How Learning Works*, *Reaching Students*, or *Small Teaching*; one or more examples of **educational research** or other articles or cases (often STEM discipline-specific). Most weeks, there will be a short pre-class assignment to submit in Moodle, designed to prompt your thinking about what you've read and/or apply it to your emerging philosophy of teaching. In this way, in-class discussions are informed by a range of ideas, disciplinary perspectives, and data.
- **Main Assignments:** Outside of short weekly assignments described above, E110 has two somewhat larger main assignments, which together **contribute 50% of your course grade.** All assignments are submitted through Moodle.
 - a) **Teaching statement or teaching philosophy:** a one- to two-page written assignment synthesizing your thoughts about teaching concepts and principles, illustrated through examples and applications relevant to your goals and career. For those who are expecting to apply for academic positions, your teaching statement may be a draft of a document you'll need for the job market. For others, it will serve to clarify your thoughts about principles of university teaching in STEM such that you can more readily apply them in the future. Your statement will be due in week 8 of the term; some of the weekly prompts will help you develop your ideas beginning early in the course.
 - b) **Short project of your choosing:** The short project allows you to take one or more key ideas from E110 and apply them to an end product that is especially relevant to you. In the past, students have: designed core elements of courses they would like to or will teach (including Caltech seminars); created assignments and articulated how they would implement them in their teaching; delved into topics not discussed in depth in E110 through annotated bibliographies, summaries, or presentations. Many other kinds of projects are possible; please don't let these suggestions limit your imagination! Each project will also be shaped by your interests and individual learning goals. You will have opportunities to propose and refine project ideas through the term and final projects will be due during final exam period.

Grades:

E110 is a pass-fail class and grades are not a main focus. Here is the formal policy: in order to pass, students need to earn at least a 60% score overall and must also:

- keep up with weekly coursework/participation (including pre-class work), and
- complete both of the two main assignments listed above.

Texts: In addition to research articles and excerpts posted in Moodle, we will draw from three main texts, all of which **are available as online books through the Caltech Library or the publisher**. If you would like your own copies/ebooks, you may purchase any edition(s):

(1) *How Learning Works: 7 Research-Based Principles...* by Susan Ambrose et al., 2010.

(2) *Reaching Students: What Research Says About Effective Instruction in Undergraduate Science and Engineering* by Nancy Kober, 2015. **(3) *Small Teaching*** by James Lang, 2016.

Auditors: Caltech/JPL auditors (postdocs, faculty, staff) are welcome provided there's room. Auditors need to commit to preparing for class and contributing actively; they should also plan to stay with the course for the full quarter. Auditors who are not participating in the CPET Certificate of Practice in University Teaching are welcome to complete written assignments and receive feedback from the instructor. Auditors who are participating in E110 as part of the Certificate of Practice follow the same grading policy as enrolled students and must do sufficient work to pass the course.

Accommodations: I would very much like to help with any concerns or needs related to disability or accessibility: please speak with me early in the term. In the case of a documented disability, please contact Dr. Barbara Green, Associate Dean of Students, x.6351, to coordinate accommodations.

Schedule: First class and organizational Meeting on Tues, 9/26 9:00-10:30 AM, CSS 360.

Day/time of weekly classes will be determined at the first meeting. See Moodle for reading/details.

Week 1 Tues., Sept. 26	Organizational meeting and course introduction: goals and outcomes, starting points, and your philosophies of teaching
Week 2 Week of Oct. 2	Prior knowledge, expertise, and organizing what we learn + individual/small group discussions with the instructor
Week 3 Week of Oct. 9	In practice: how can teaching develop students' knowledge in STEM? <i>Note: "In practice" classes will especially focus on pedagogical methods</i>
Week 4 Week of Oct. 16	Students inner worlds and why they matter in STEM: motivation, identity, and cognitive/social development
Week 5 Week of Oct. 23	NO CLASS MEETING THIS WEEK: you will have assigned work to help you make progress on the two "main assignments" in E110
Week 6 Week of Oct. 30	Diversity and inclusive teaching in STEM fields: paradigms, privilege, and purpose in the classroom
Week 7 Week of Nov. 6	In practice: how can activity and assessment develop students' understanding in STEM?
Week 8 Week of Nov. 13	Putting it all together: the course design process * Teaching philosophies/statements will be due this week *
Week 9 Week of Nov. 20	Emerging topics in STEM education: the class will decide what additional topics they would like to explore this week
Week 10 Week of Nov. 27	FINAL CLASS: course wrap-up and teaching philosophy/project discussions. * Individual projects due Friday, Dec. 8 *