Syllabus: E 110, Principles of University Teaching and Learning in STEM
Fall Quarter 2019. 3 units (2-0-1; in practice closer to 1.5-0-1.5)

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Class Time: **Mondays 1:30 – 3:00 pm**
Center for Teaching, Learning, & Outreach (CSS Room 360)

Office Hours: Flexible; please e-mail to make an appointments.

Website: Class website will in Moodle, http://moodle.caltech.edu, also linked through access.caltech.edu. E110 is under "E (FA 2019)"; enrollment key "horii".

Description:

This graduate course examines the research on university-level STEM (science, technology, engineering, and mathematics) teaching and learning, which has been used to inform a well-established body of evidence-based teaching practices. 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. 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 explore the roles of active learning, student engagement, and inclusive teaching practices in designing classes where all students have an equal opportunity to be successful and feel a sense of belonging, both in the course and as scientists. 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 an "Emerging Topics" class session. I hope that the class will **prepare you to be an effective, articulate, and self-directed university instructor and advanced life-long learner**, whether in academia or elsewhere.

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 coursework and 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 or Reaching Students;* one or more examples of **educational research** articles (often discipline-specific). In this way, in-class discussions are informed by a range of ideas, disciplinary perspectives, and data. There will normally be a short pre-class assignment to submit in Moodle, designed to prompt your thinking about what you've read, apply ideas to your emerging philosophy of teaching, or build toward your individual project (see below).
- **Assignments:** E110 has two major assignments, which together **contribute 50% of your course grade.** Both assignments are required in order to pass and will be submitted through Moodle.
    a) **Teaching statement or teaching philosophy**: a 1.5 to 2 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.
    b) **Individual project:** The project is your opportunity to design and carry out independent work, in which you will apply one or more key ideas from E110. Your project should be shaped significantly by your specific interests and learning goals. Example projects include: designing an annotated syllabus for a course you may teach in the future; designing assignments in a course so that they are more transparent and effective; researching a teaching topic not discussed in E110. Many other project formats are possible; please don't let these suggestions limit your imagination.

Grades:

E110 is a pass-fail class and grades are not a main focus. Formally, passing requires a minimum grade 60% overall; you must (1) complete weekly coursework, (2) participate fully in-class work, and (3) complete both of the main assignments in order to pass.

Texts: In addition to research articles and excerpts assigned weekly, we will draw from two main texts, which **are available as online books through the Caltech Library or the publisher**:

(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.

Auditors: Auditors (e.g., Caltech staff and postdocs) are welcome on a space available basis and are expected to complete all coursework and fully participate in the class.

Accommodations: I would very much like to help with any concerns or needs related to accessibility: please speak with me early in the term. Students who may need an academic accommodation based on the impact of a disability must initiate the request with Caltech Accessibility Services for Students (CASS). Professional staff will evaluate the request with required documentation, and recommend reasonable accommodations. Students should contact CASS as soon as possible, since timely notice is needed to coordinate accommodations. http://cass.caltech.edu/. Undergraduate students should contact Dr. Lesley Nye, Associate Dean of Undergraduate Students (administrative contact: Beth Larranaga) and graduate students should contact Dr. Kate McAnulty, Associate Dean of Graduate Studies (administrative contact: Angelica Medina-Cuevas).

Schedule: E110 meets Mondays 1:30 – 3:00 pm, CSS Room 360.

Week 1 Individual meetings	During week 1 of the fall 2019 term, there are no classes on Monday, September 30 (Classes begin on Tuesday, October 1). ***Please schedule an individual meeting with Cassandra via Moodle during week 1 or week 2 of the quarter.***
Week 2 Mon., Oct. 7	Course introduction: Goals and outcomes, your teaching philosophy, and foundations of evidence-based instruction.
Week 3 Mon., Oct. 14	Designing courses and instruction from start to finish: a framework for scientific teaching.
Week 4 Mon., Oct. 21	Understanding Learning: prior knowledge, expertise, and organizing our knowledge.
Week 5 Mon., Oct. 28	In practice: active and inclusive classrooms, part I. *Note: "In practice" classes will especially focus on pedagogical methods*
Week 6 Mon., Nov. 4	Understanding Students: motivation, identity, and cognitive/social development.
Week 7 Mon., Nov. 11	Assessing student learning: Assignments, exams, and more.
Week 8 Mon., Nov. 18	In practice: active and inclusive classrooms, part II. **Assignment (a): Teaching statements due Wednesday, Nov. 20**
Week 9 Mon., Nov. 25	Emerging topics in STEM education: we will decide as a class what topics to explore this week.
Week 10 Mon., Dec. 2	Final Class: Course wrap-up and microteaching practice.
Week 11 no class meeting	**Assignment (b): Individual project due Wednesday, Dec. 11**