E 110. Principles of University Teaching and Learning in STEM **Syllabus**
Winter Quarter 2017. *2 units (1-0-1)* *Subject to updates*

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Class Meetings: (likely) Wednesdays 10-11AM, Center for Teaching, Learning, & Outreach

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

Website: Class page will be in Moodle, http://moodle.caltech.edu.
E110 will be listed under "E (WI 2017)"; enrollment key will be "weaver".

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, a course designed to enable you to achieve these **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 view 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.

Weekly Coursework & Participation:
Most weeks, you'll have **a choice of readings**: either a chapter in one of our **core texts *How Learning Works or Reaching Students*** or a selection of **primary research articles** on the subject (often discipline-specific), so that our discussion can bring in a range of data and perspectives. At times, weekly work may include preparation of a discussion question, a short draft or segment of projects, or input on the Emerging Topics sessions. As a 2 unit (1-0-1) pass-fail course, shaped in part by your participation, your **contributions in class** are essential. ***Weekly Coursework & Participation will compose 50% of your course grade.***

Textbooks:

- *How Learning Works: 7 Research-Based Principles for Smart Teaching*, Susan Ambrose et al.. San Francisco: Wiley & Sons, 2010. ISBN-10: 0470484101. You may use any edition (print or e-book).
- *Reaching Students: What Research Says About Effective Instruction in Undergraduate Science and Engineering*, Nancy Kober, Washington, DC: National Academies Press, 2015. Available online.

Projects:

Projects are your opportunity to design and carry out independent work that will:

a) Advance your individual learning goals in university-level teaching and learning;
b) Apply coursework (readings, discussion, ideas) to an end-product that is useful to you;
c) Provide you with in-depth feedback from peers and the instructor;
d) Be of an appropriate scope and depth to carry out in about five hours of focused work.

Example projects include: assembling a teaching portfolio (including writing a statement of teaching philosophy), designing a syllabus for a course you may teach in the future, formulating a research question/study design about teaching and learning*, implementing and assessing a teaching and/or learning strategy. Many other project formats are possible; please don't let these suggestions limit your imagination. Each project will also be shaped significantly by your specific topical interests and learning goals. ***Projects will compose 50% of your course grade.***

Schedule:

Please refer to the course Moodle site for all assigned readings and work.

Week 1, Wed., Jan. 4	Course Overview & Intro: Building Expertise and Organizing Knowledge
Week 2, Wed., Jan. 11	Prior Knowledge & Misconceptions
Week 3, Wed., Jan. 18	Student Development: Cognition, Agency and Self-directed Learning
Week 4, Wed., Jan. 25	Practice, Feedback and Assessment
Week 5, Wed., Feb. 1	Inclusive Teaching and Diversity in STEM Education
Week 6, Wed., Feb. 8	Emerging topic 1: Class will determine topic
Week 7, Wed., Feb. 15	Emerging topic 2: Class will determine topic
Week 8, Wed., Feb. 22	Projects: progress reports, discussion, feedback, next steps
Week 9, Wed., Mar. 1	Flexible Day: Emerging topic 3 &/or Project Work
Week 10, Wed., Mar. 8	FINAL CLASS: Course wrap-up
Week 11, Wed., Mar. 15	Last day to turn in final project documents.

Grades: E110 is a pass-fail class and grades are not the main focus. Formally, passing requires a minimum of 60% overall; both the weekly coursework and project are required in order to pass.

Caltech/JPL Auditors: You are welcome to audit, provided that there's room and that you will contribute in class!

Accommodations: Should any course-related concerns or needs arise related to a disability or accessibility issue, I would very much like to help as early in the quarter as possible, so please let me know. In the case of a documented disability, please contact Dr. Barbara Green, Associate Dean of Students, x.6351 to coordinate any special accommodations.

* Note that Human Subjects Training and IRB review are required for conducting any research involving students; depending on interests, we could discuss the process during E110.