

Transforming STEM Teaching Faculty Learning Program

A program of the University of California Berkeley Lawrence Hall of Science & the Center for Teaching and Learning

Program focus: Productive Discourse. Even in large STEM lectures, students show positive change in their understanding of difficult and complex concepts when given the opportunity to reflect, talk, argue, and defend their ideas. In addition, they show greater understanding when they engage in collaborative dialogue with peers where they provide explanations as part of arguments and justifications. This project focuses on building faculty's: understanding of how learning happens from the learning sciences; knowledge of how students understand core ideas and cross-cutting concepts from disciplinary-based education research; and instructional abilities to facilitate productive discourse to support learning in their classes.

Program structure: Meetings & Activities. The program commences with a **two-day, in-person workshop** at UC Berkeley near the start of the first term. The workshop introduces faculty to one another, establishes the goals and structure of the program, and places faculty as learners experiencing the instructional practices they will develop in their own practice. Activities and discussions include: (1) discussing research on learning to inform design of their courses; (2) becoming familiar with the learning management system they will use as participants of the program; and (3) introducing the faculty learning community.

In Part 1, faculty take part in a series of **seven 1.5-hour synchronous, online interactive workshops** offered every two weeks, as well as **asynchronous, online reflective discussions** that occur during alternating weeks. The synchronous sessions guide faculty through the process of redefining their role as instructor in their college courses, as they develop deeper understanding of how learning happens and how to support learning. Video conferencing makes the online interactive sessions accommodating to faculty's busy personal and professional schedules during the academic year. These synchronous sessions will further engage faculty in discussions and activities on learning research, continue to model instructional practices they can use in their classes, and challenge faculty to try-out specific strategies in their courses, and then reflect on and share the successes, difficulties, and student reactions to the strategies. Faculty will also have the semester- or quarter- long task of redesigning a large STEM lecture course or topic/concept that they will teach in the second term of the program.

In Part 2, sessions focus on peer observations to develop faculty's skills in observing and providing feedback on teaching practice. The peer observations offer faculty: opportunity to use evidence to reflect on their practice with a colleague; develop knowledge and skills for observing and reflecting on practice; and an applied way to revisit their understanding of learning and teaching. **Three 1.5 hour**

synchronous, online interactive sessions introduce the peer observation protocol, and give faculty the chance to experience discussing practice with videos from past FLP Fellows. The observation protocol is qualitative in nature, and structured in such a way to generate a safe space for giving and receiving feedback. Following the online sessions, faculty are all tasked to collect at least two videos of their teaching practice. Each faculty will have two peer observation feedback of their teaching.

Part 1 Progression

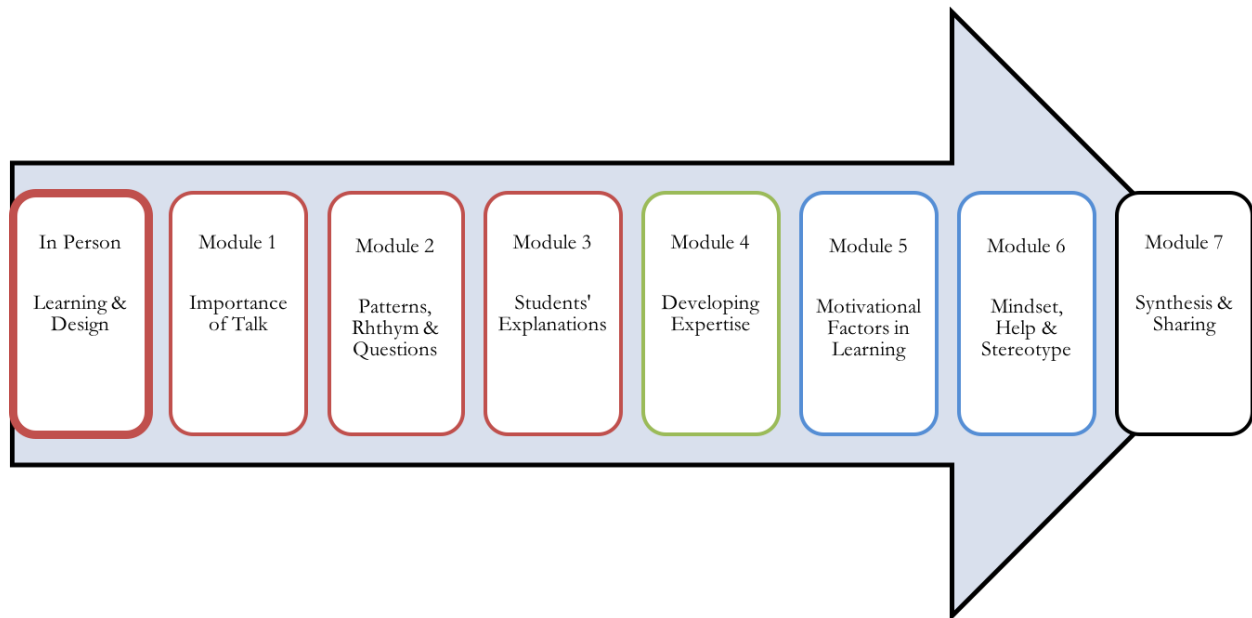
Focuses on deepening faculty's understanding of how learning happens, and how to support learning in teaching. In each session, participants discuss ideas from the research literature, and engage in activities to reflect on and apply their understanding of the topic.

- **In person *Learning & Design Workshop*:** The purpose of this workshop is to immerse participants in current research on learning. They experience a variety of active learning designs and strategies, which serve as common experiences for discussion in subsequent synchronous sessions. They discuss the possibilities and limitations of the designs and strategies, and consider how they can use these designs in their classrooms. Participants are introduced to the Backwards Design model as an organizational framework for approaching how they design their classes.
- **Module 1, *Learning Conversations*:** The purpose of this session is to discuss the essential role of talk for students to understand content, develop richer and more complex mental models, and motivate students to engage. Participants are introduced to the Discussion Map as a tool to guide them in leading class discussions, and other strategies for creating a discursive classroom.
- **Module 2, *Patterns, Rhythms, & Questions*:** The purpose of this session is to examine the patterns and rhythms in class discussions, and consider how to align teaching purposes to instructional decisions. Participants are introduced to a framework on designing questions that has been designed for university-level teaching, and practice how to use the framework.
- **Module 3, *Students' Explanations*:** The purpose of this session is to discuss how students' explanations are sources of information about their understanding. Participants discuss the different types of misconceptions and how to change misconceptions, and reflect on moving their students along the novice to expert continuum.
- **Module 4, *Developing Expertise*:** The purpose of this session is to examine how learning evolves into expertise through actions taken studying, gathering, and using feedback and assessments, and reflection. Being able to regulate ones' learning is critical for developing expertise, hence this literature is the centerpiece of this module. Practical tools for formative feedback and assessments, study skills, and exam wrappers are offered for consideration.
- **Module 5, *Motivational Factors in Learning*:** The purpose of this session is to discuss what affects students' motivation to learn. Participants discuss three psychological factors that affect learners' motivation: self-efficacy, interest, & goals.
- **Module 6, *Mindset, Help & Stereotype*.** The purpose of this session is to complete and deepen the conversation on motivation. Participants discuss self-regulated learning processes including cognitive strategies for deep learning; followed by

information about mindsets (growth vs fixed) and stereotype threat, and how this knowledge can be used to help students succeed. Participants are introduced to the Learning Cycle as an instructional model to incorporate the research on learning and teaching that has been discussed in the program.

- **Module 7, *Synthesis & Share*:** The purpose of this session is for participants to synthesize and share what they learned this semester. Participants share their plans to apply this knowledge in their teaching next semester.

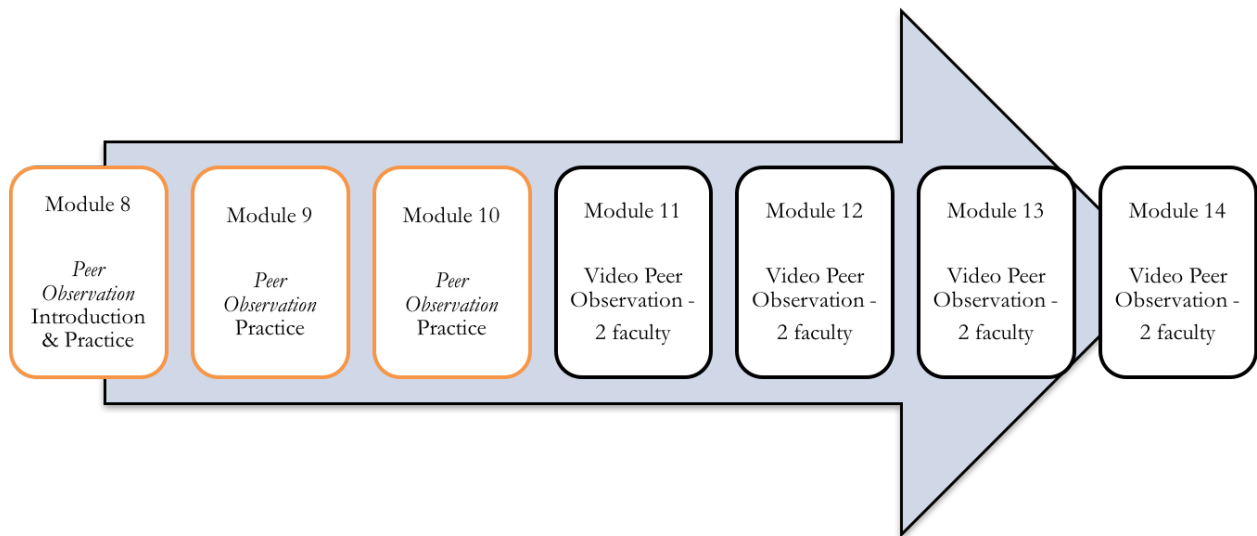
Asynchronous Sessions: Participants have two tasks to complete between meeting together online. They read a research paper and discuss how the ideas apply to their own teaching. They also try out a teaching strategy or approach that was discussed in the previous synchronous session, and share how it went.



Part 2 Progression

Focuses on peer observations to provide and receive feedback on their teaching.

- **Online Sessions 8-10.** Three online synchronous sessions are focused on learning and practicing the observation protocol using videos from past FLP Fellows. If possible, one past FLP participant joins an online session to discuss his/her video.
- **Peer Observation, Sessions 11-14.** Each faculty will have opportunity for two video discussions of their practice. These sessions will be facilitated in the same way as the practice session, though they can occur in-person or online. Videos from two different faculty will be discussed during each session.



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Design and development led by The Lawrence Hall of Science and the Center for Teaching and Learning (CTL) at the University of California, Berkeley.

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- Todd Zakrajsek, University of North Carolina at Chapel Hill
- Brett Christie, California State University, Office of the Chancellor
- Tish Young, Senior Dean of Instruction, Contra Costa Community College
- Lynn Stauffer, STEM Dean, Sonoma State University

Faculty Participant Testimonials

Through their participation in the program UC Berkeley instructors were able to redesign and improve their courses. Here are their reflections on their re-designed courses:

Dr. Michelle Douskey

Chemistry 4B - General Chemistry and Quantitative Analysis

For many years I have taught Chem 4B, General Chemistry and Quantitative Analysis for the chemistry majors, and have seen how students struggle to make the right experimental decisions when designing their own research projects for the lab course. This motivated me to try flipping the classroom for the first time in spring 2015 for my course of 200-250 students. I designed one flipped classroom a week, called Flipped Friday. I recorded a short lecture video which the students watched in preparation of class. They were given a short quiz on bcourses to ensure they had watched the video. Students were instructed to sit with their assigned lab section in class and the GSIs helped facilitate group work. The in class worksheets consisted of real analytical problems with data I had gathered on our own departmental instruments. Students were instructed to work in groups of four, each person assuming a different role in the group (manager, reader, calculator, and reflector) to accomplish the tasks at hand. Answers were presented in class and students were asked to correct their own work and reflect on their understanding. The results were largely positive. Of the students that responded 88% stated that the activities helped them to identify areas of confusion and 83% stated it helped them to prepare for exams.

Professor Matthew Potts

Environmental Science, Policy, and Management 15 - Introduction to Environmental Sciences

Over the past couple years, my colleagues and myself have redesigned our introductory environmental science class to emphasize active learning and student engagement. To accomplish this we have added three key features to our course. First, we begin each course unit with a pre-module that introduces students to the unit's topics in fun and interactive way. For example, in the module on ecosystems, students will be asked to think about how they would design a life-support system for a spaceship to Mars. Second, we have incorporated multiple interactive check-in activities during traditional stand-up lectures, such as think-pair-share. Finally, we culminate each unit with capstone experiential learning activity. For example, for our unit on society-nature relations we have an in-class debate on the Drakes Bay Oyster Company controversy at Point Reyes. Together these changes force the students to more critically engage in the material. My next challenge will be flipping an upper division resource economics class this coming Spring semester.