STEM Teaching Professional Development: A Faculty Teaching Learning Program

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Active learning can be an effective tool to enhance student understanding in any discipline. STEM faculty, however, require unique support to integrate active learning strategies into their instructional practice. This is apparent when examining the literature on the application of active learning techniques in science and engineering undergraduate courses. In one example, a study of introductory biology instructors found no association between faculty's use of active learning methods and students' learning gains [1]. The authors argued that much of the literature on the success of active learning in STEM fields examines courses taught by science education researchers. It cannot be assumed that STEM faculty can adopt evidence-based teaching methods into classes effectively. Rather, STEM faculty needed to build STEM education expertise upon which to make informed instructional decisions. To that end, a faculty learning program was created in collaboration between UC Berkeley and the Lawrence Hall of Science.

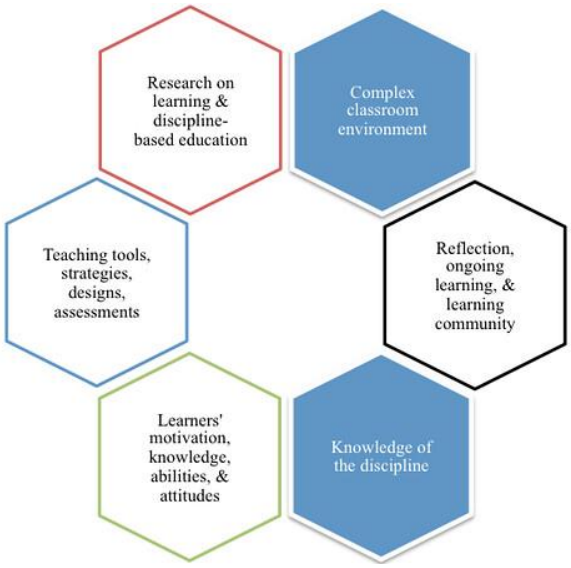

Figure 1. Components of the faculty learning program, revised from Ed Prather's model of science education pedagogical content knowledge in higher education [2]

The program, written and developed by Lynn Tran and Catherine Halversen, received NSF funding (DUE #1626624) under the title "Transforming STEM Teaching Faculty Learning Program," abbreviated FLP. The FLP is structured around Ed Prather's (University of Arizona) model of science education best practices and provides faculty with tools and support to effectively incorporate active learning into their classrooms. A modified version of the Prather model is shown schematically in Figure 1. The elements shaded in blue (classroom environment and content knowledge) are not addressed directly in the FLP as they are unique to each instructor and course. The elements outlined in red (learning research), blue (assessment) and

green (motivation and abilities) are treated iteratively throughout the program. Finally, the element of reflection, outlined in black in Figure 1, is not part of Prather's model, but is a critical component of the faculty learning program and a key tool in the development of STEM Education expertise.

As outlined by Tran and Halverson [3], the objectives of the program are to:

- Deepen faculty's understanding of how people learn
- Change teaching behavior to support student learning
- Engage STEM faculty in habits of reflection
- Nurture a tradition of continued learning about teaching
- Build a faculty learning community

The FLP is a full year (two-semester) course completed by a faculty cohort and lead by a team of facilitators. The program can be run in person or online. Figure 2 shows an outline of the topics covered in the first half of the program. Each module involves examination of literature in STEM education and examples of techniques being used in practice. Useful handouts are provided that reference research findings and synthesize key points. Biweekly meetings present opportunities for participants to observe techniques being applied in university level STEM classrooms. In each session a tool is described with step-by-step guidance on how to adopt a new technique in the classroom. The program is designed to be completed by faculty during the academic year, while they are actively engaged in teaching. The time commitment is relatively low, and changes in instructional practice take place in real-time as faculty implement techniques they are learning each week and report back to the cohort for feedback and support.

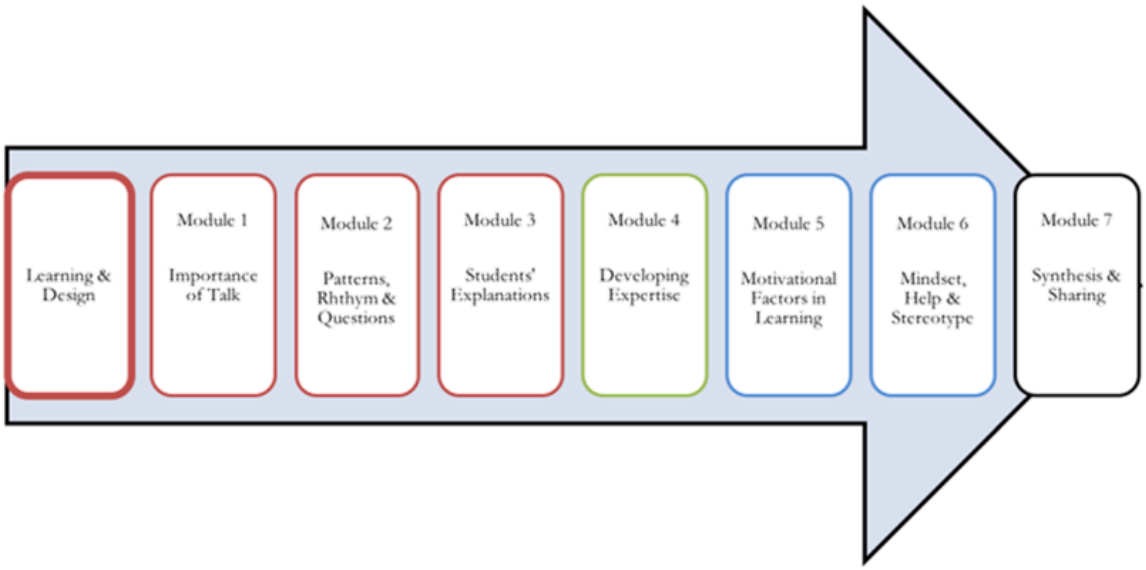

Figure 2. Summary of the first half of the FLP, structured around 7 content modules [2]

While not currently offered at UC Berkeley, the program has been adopted at the University of Southern California under the name "STEM Faculty Teaching Learning Program (FTLP)" and is

offered once a year to interested faculty teaching STEM courses. Facilitators and cohort members come from a diverse range of STEM departments from both the college of letters arts and sciences and the engineering school. Following one semester of content modulus the program culminates in a semester of peer observation.

Peer observation of teaching is a divisive topic among faculty. Universities across the country, however, are moving away from the student course evaluation as a primary assessment of teaching effectiveness and looking to peer observation as a potential substitute and/or augmentation. A strength of the FTLP is the introduction and use of a formalized observation protocol. With clear expectations on the part of both the faculty presenter and the observer, this protocol leads to productive and actionable feedback and eliminates much of the fear and discomfort associated with observation. After completing the FTLP, members of the faculty cohort have experience with observation and can assist their home departments with facilitation of structured observation.

In this presentation the full program will be described, attendees will participate in a learning activity, and the peer observation protocol will be introduced. Information on how to join a future cohort will be provided for those interested.

References

1. TM Andrews, MJ Leonard, CA Colgrove, and ST Kalinowski. Active learning not associated with student learning in a random sample of college biology courses. CBE Life Sciences Education 10(4):394-405, 2011
2. L Tran and C Halversen, "Transforming STEM Teaching Faculty Learning Program [Curriculum]," The Regents of the University of California, Berkeley, CA.
3. UC Berkeley Center for Teaching & Learning, Transforming STEM Teaching Faculty Learning Program https://teaching.berkeley.edu/programs/transforming-stem-teaching-faculty-learning-program