

# **Work In Progress: Developing a Faculty Community of Practice to Support a Healthy Educational Ecosystem**

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## Work In Progress: Developing a Faculty Community of Practice to Support a Healthy Educational Ecosystem

We STEM educators often hear that so many of our students fail because they are not college ready. But interventions at various levels, despite the hard work of implementation, have not resulted in dramatic improvements. What if, instead, the problem is that the institutional system – including instructional approaches and policies – is not student ready? The goal of our NSF-supported project, called “Eco-STEM,” is to establish a healthy STEM educational ecosystem that allows all individuals within the ecosystem to thrive [1]. The context for our work on STEM educational ecosystems is a Very High Hispanic Enrolling Hispanic-Serving Institution (HSI) at California State University, Los Angeles, where the majority of our students are also low-income and first-generation college students [2]. Guided by an ecosystem paradigm [3], the project aims to: 1) create a supportive and culturally responsive learning/working environment for both students and faculty; 2) make teaching and learning rewarding and fulfilling experiences; and 3) emphasize the assets of our community to enhance motivation, excellence, and success.

Currently, many STEM educators have a mental model of the education system as a pipeline or pathway, and this factory-like model requires standard inputs, expecting students to come prepared with certain knowledge and skills [4]. When the educational system is viewed as a factory assembly line (as shown in Figure 1), interventions are focused on fixing the inputs by trying to increase students’ preparedness, which contributes to a prevailing deficit-focused mindset. This not only hinders student growth but also makes educational institutions less inclusive and teaching less rewarding for faculty. Increasingly, equity-minded educators [5–6] and researchers employing the framework of community cultural wealth [7] suggest that we need an asset-based mindset if we are to help all students achieve success in STEM. Research on ecosystem models offers a new way of thinking [3, 8]. In contrast to pipelines or pathways, which focus on student outcomes, an ecosystem model is centered on the learning environment, communities, and the experiences that diverse students, faculty, and staff have in the system as active agents.

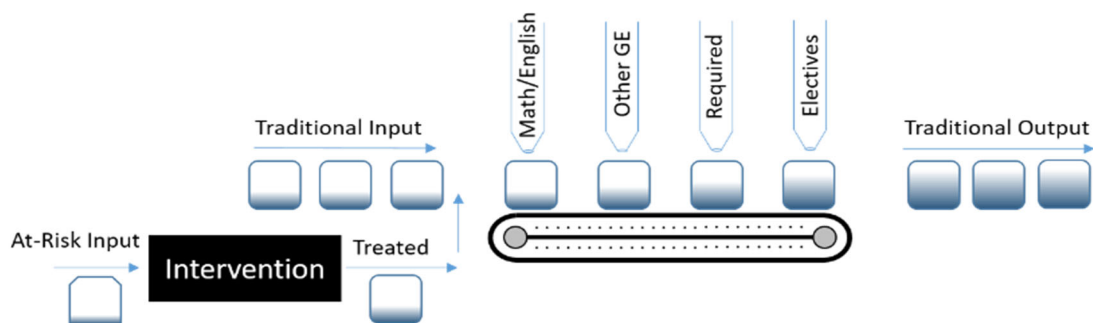


Figure 1. Traditional factory-like university model

The Eco-STEM project proposes to: 1) shift the mental models of STEM faculty from factory-based to ecosystem-based so that they will intentionally establish healthy classroom ecosystems that facilitate learning for all students regardless of their backgrounds; 2) change the mental models and develop the capacity of department chairs and program coordinators so they can lead the cultural changes needed to create a healthy ecosystem at the department level; and 3) revise

the teaching evaluation system to promote faculty development and enhance the student experience, which will help to create a healthy ecosystem at the institution [1]. One fundamental aspect of this project is the Eco-STEM Faculty Fellows Community of Practice (CoP), which is designed to help foster these changes. As a work-in-progress paper, this paper presents the design and structure of the Eco-STEM Faculty Fellows CoP and seeks input from the faculty development community on our approach to fostering a healthy educational ecosystem for the majority marginalized student population we serve.

### Eco-STEM Faculty Fellows CoP Curriculum

The Eco-STEM Faculty Fellows CoP is a yearlong program with nine half-day sessions, five during the fall semester and four in the spring (as shown in Figure 2). During the fall semester, the program includes topics such as social identities, community cultural wealth, inclusive pedagogy, and community building. At the end of the semester, fellows propose a critical, participatory action research teaching (ART) project to be implemented in the spring semester. The spring semester focuses on supporting fellows as they implement their ART projects, which they will continue to iterate upon in future semesters. The key to the CoP sessions throughout the year is critically reflective dialogue [9–10] within a safe and supportive environment that supports the whole community, including fellows and facilitators, to learn and grow. In addition to the nine CoP sessions, fellows are invited to participate during the fall in an Inclusive Teaching Program (CETL ITC) offered through our Center for Effective Teaching and Learning [11] and during the spring in the Howard Hughes Medical Institutes Inclusive Excellence & Equity Fellows Program (HHMI), which is based on the Center for Urban Education’s Racial Equity-Minded Series [12–13].

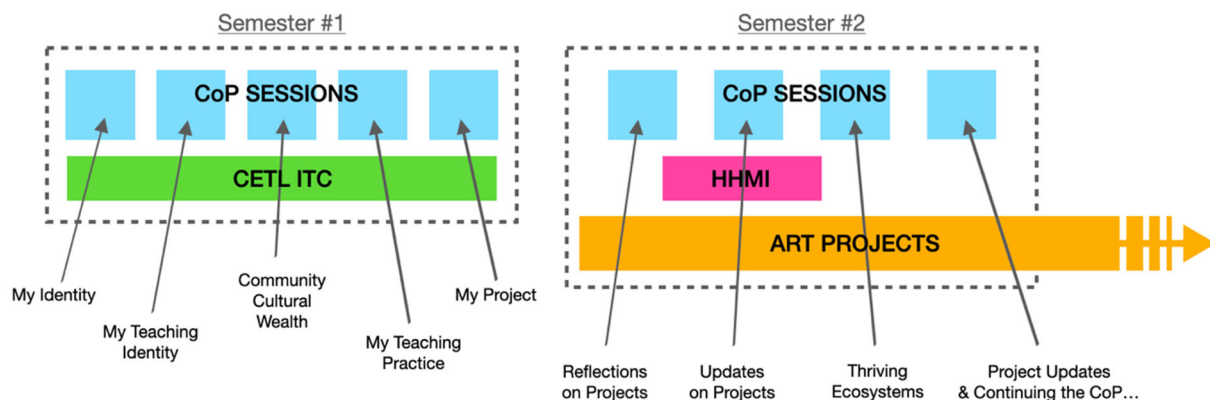


Figure 2: Eco-STEM Faculty Fellows Community of Practice Structure

During the fall semester, the Eco-STEM Faculty Fellows CoP sessions include readings, videos, active-learning activities, and critically reflective dialogue to facilitate discussion and reflection on identity, teaching identity, community cultural wealth, teaching practice, and action research. Details on the topics covered in these sessions are shown in Figure 3 and are described below.

**My Identity:** This session includes: a think-pair-share ice-breaker activity, in which fellows select an image that captures their identity in college and discuss the ways our stories help us think about the stories of our students and the impact we can have in guiding their overall college

experience [13]; an activity in which fellows map their identities onto a social identity “wheel” and identify their most salient identities [13]; a video on an emancipatory teaching practice in a technical course, in which the women authors reflect on oppressive “normal” engineering dynamics reflected in a reviewer’s story of sexual harassment in the workplace [14]; and a critically reflective dialogue on fellows’ responses to the video, how their identities related to their response, and what incidents similar to those described in the video they have noticed in their experiences in academia.

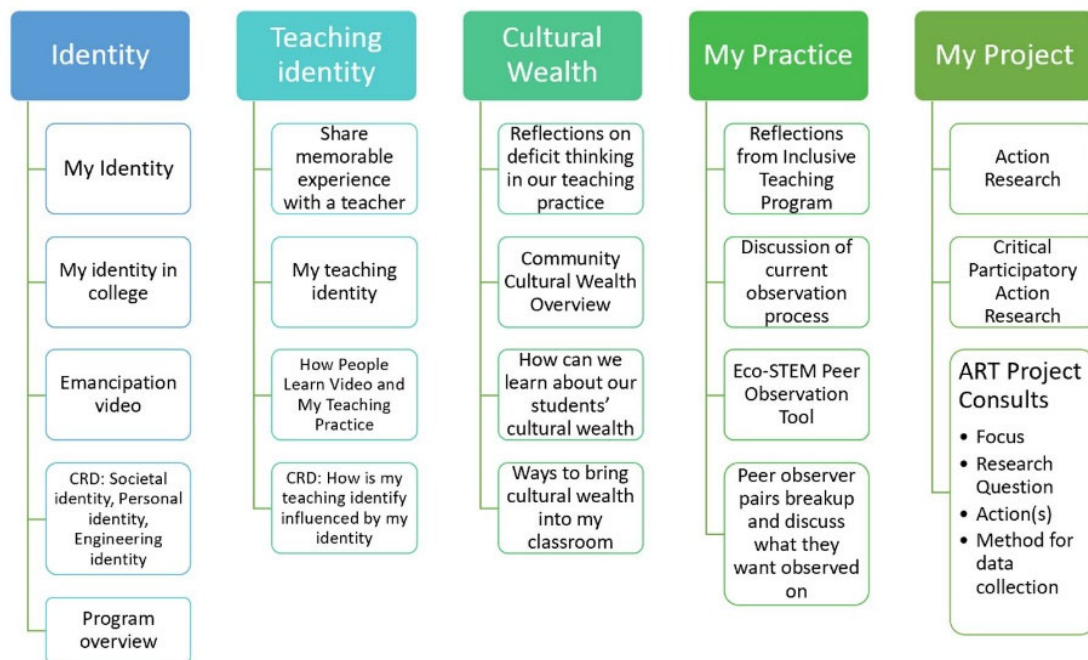


Figure 3. Eco-STEM Faculty Fellows Community of Practice Structure for first semester.

**My Teaching Identity:** This session includes: a think-pair-share reflection on a memorable experience fellows have had with a teacher; watching the video “How We Learn” [15]; a small group discussion activity on five philosophies of teaching and learning (1) creating a safe space, 2) multiple entry points, 3) cognitive conflict, 4) passive vs. engaged learning, and 5) intrinsic motivation); a critically reflective dialogue on which ideas from the “The Heart of a Teacher” [16] (assigned in the Inclusive Teaching Program [11]) they agreed or disagreed with and how their identity and their awareness of their identity influence their teaching.

**Cultural Wealth:** This session focuses on Yosso’s framework of community cultural wealth [7] and includes: a short reflective writing exercise on how fellows connect with students and help students connect with the material; a small group discussion on Yosso’s description of deficit thinking and Freire’s banking model of education [17]; a journal reflection on how their approach to connecting with students may reflect deficit thinking; a discussion of Yosso’s six forms of community cultural capital (aspirational, linguistic, familial, social, navigational, and resistant) [7] including examples from our own students’ perspectives related to each type of capital; and a pair-share discussion on how fellows can learn about their students’ community cultural wealth and incorporate it into their instruction.

**My Practice:** This session focuses on the Eco-STEM Peer Observation Tool [18–19] (inspired by the University of Arizona’s “Peer Review of Teaching Protocol” [20]), which includes a list of observable behaviors related to the key indicators of a healthy ecosystem in the classroom (Table 1). Fellows become familiar with the tool and, with a partner, identify areas they want to be observed on before the next CoP session.

Table 1. Key indicators of a healthy ecosystem in the classroom

<b>Climate:</b> supportive, inclusive, And recognizing cultural assets	<b>Structure:</b> facilitate the learning process	<b>Vibrancy:</b> activity and level of engagement
<ul style="list-style-type: none"> <li>• Knows students as individuals</li> <li>• Encourages questions</li> <li>• Expresses belief in students' capacity and potential</li> <li>• Creates an inclusive environment</li> </ul>	<ul style="list-style-type: none"> <li>• Provides clear goals/outcomes</li> <li>• Class has organization &amp; Sequence</li> <li>• Instructional design based on knowledge of how people learn</li> <li>• Activities structured to develop effective learners</li> </ul>	<ul style="list-style-type: none"> <li>• Passionate about the discipline</li> <li>• Use active learning properly</li> <li>• Dynamics between students</li> <li>• High level of engagement</li> <li>• Motivated and deep learners</li> </ul>

**My Project:** This session focuses on critical participatory action research [21]. Prior to this session, fellows watched two videos: one on action research in education [22] and one on theoretical frameworks for education research [23]. They were also provided with a list of educational theories [24] including references from foundations in education, foundations in STEM education, and applications in STEM education. The session included: a think-pair-share activity on fellows’ muddiest points from the videos and questions regarding the implementation of their ART projects; a presentation on critical participatory action research (Figure 4) [25]; and ART project planning discussions (in pairs who observed each other's teaching prior to the session), which included consultations with facilitators.

### Critical Participatory Action Research








-  Developed in conjunction with community
-  Centering Marginalized voices
-  Requires informed consent
-  Recognizes researcher as influencing the system not just observer
-  Explicitly addresses power differentials
-  Structural changes are the goal
-  Increases capacity of all involved

Figure 4: Key aspects of Critical Participatory Action Research [25]

### Community Building

The process of community building starts with the recruitment and selection of fellows. Fellows complete a short five-question intent form, including one question that asks if there are aspects of the STEM undergraduate learning experience that should change to meet our students “where they are” and make the experience of teaching more rewarding. Each applicant is then invited to discuss with Eco-STEM team members what they believe faculty and students need to thrive, the assets our students possess, and how they use feedback to improve their teaching and students’ learning.

The first CoP session begins with introductions, including sharing pronouns, and we develop a group agreement for community engagement that is revisited throughout the year. Starting with the second CoP session, each session begins with a check-in, in which everyone is invited in turn

to share what is on their minds. This helps members put aside those thoughts to focus on the days' activities and helps to build community. We also frequently remind fellows about the comfort, growth, and panic zones [26], encouraging them to strive to stay in the growth zone and asking them to let us know if they feel like they are in the panic zone. Finally, each session ends with fellow and facilitator reflections. Fellows are asked for their "muddiest points" and their "aha" moments from the day's session. Facilitators are asked in what ways they saw instances of factory-based mental models at play in participants' responses or in themselves and what "aha" moments happened during the session, for either participants or the facilitator. These reflections help provide closure to each session, are summarized and shared at the next session to provide continuity between sessions, and are used in our program assessment.

### **Assessment and Future Work**

The Eco-STEM project is developing several tools (e.g., [27]) to study the following research questions: 1) "To what extent do the Eco-STEM CoPs effectively shift the mental models of participants from a factory-like model to an ecosystem model of education?"; 2) "To what extent does this shift allow for an emphasis on the assets of our students, faculty, and staff members and, in turn, allow for enhanced motivation, excellence and success?"; and 3) "To what extent do new faculty assessment tools designed to provide feedback from within the context of ecosystem feedback allow for individuals in the system to thrive?"

We are currently in the middle of our first Eco-STEM Faculty Fellows CoP, which started in Fall 2021. The first cohort of ten ART fellows consists of a diverse group with respect to racial, ethnic, and gender identities and in terms of their department – with adjunct and tenure-line faculty of all ranks from mathematics, computer science, civil engineering, electrical engineering, and mechanical engineering. Fellows have proposed a wide variety of ART projects to be conducted both inside and outside the classroom, and we are currently helping them explore and enhance the critical and participatory aspects of their projects.

Based on initial reflections from the authors/facilitators, the most impactful session from the fall semester was our session on community cultural wealth. Critically reflective dialogue has helped the community deepen their understanding of identity and its impact and the need for critical change within the educational system. In the future, we will better scaffold the fellows' work on their ART projects over the fall semester to provide more support in an area of research that is unfamiliar to many of our fellows. However, the progress of the CoP thus far renders us confident that the curriculum and engagement has made a concrete start to the task of transforming the environment to reflect an educational ecosystem in which students, faculty, and staff thrive while teaching and learning.

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## References

- [1] G. B. Menezes, C. L. Bowen, J. Dong, N. Warter-Perez, L. L. Thompson, S. Heubach, D. Galván, J. G. Mijares, and E. Schiorring, "Eco-STEM: Transforming STEM Education using an Asset-based Ecosystem Model," in ASEE Annual Conference and Exposition, 2022.
- [2] Office of Institutional Effectiveness, "Student Enrollment," California State University, Los Angeles. Available: <https://www.calstatela.edu/InstitutionalEffectiveness/student-enrollment> (accessed May 9, 2021).
- [3] S. M. Lord, M. W. Ohland, R. A. Layton, and M. M. Camacho, "Beyond pipeline and pathways: Ecosystem metrics," *J. Eng. Educ.*, vol. 108, no. 1, pp. 32–56, 2019, doi: 10.1002/jee.20250.
- [4] H. Metcalf, "Stuck in the Pipeline: A Critical Review of STEM Workforce Literature," *Interact. UCLA J. Educ. Inf. Stud.*, vol. 6, no. 2, 2010, doi: 10.5070/d462000681.
- [5] K. Witham, L. M. Malcom-Piqueux, A. C. Dowd, and E. M. Bensimon, "America's unmet promise: The imperative for equity in higher education," Washington, DC: Association of American Colleges and Universities, 2015.
- [6] A. P. Carnevale and J. Strohl, "Separate & Unequal: How higher education reinforces the intergenerational reproduction of White racial privilege," Washington, DC: Center on Education and the Workforce, Georgetown University, 2013. Available: <https://cew.georgetown.edu/cew-reports/separate-unequal/>.
- [7] T. J. Yosso, "Whose culture has capital? A critical race theory discussion of community cultural wealth," *Race Ethn. Educ.*, vol. 8, no. 1, pp. 69–91, 2005, doi: 10.1080/1361332052000341006.
- [8] W. C. Lee, "Pipelines, pathways, and ecosystems: An argument for participation paradigms," *J. Eng. Educ.*, vol. 108, no. 1, pp. 8–12, 2019, doi: 10.1002/jee.20241.
- [9] R. Burton, L. Schlemer, and L. Vanasupa, "Transformational innovation: Reflections on how to foster it in engineering education systems," *Int. J. Eng. Educ.*, vol. 28, no. 2, pp. 275–285, 2012.
- [10] L. T. Schlemer, L. De Greef, and T. S. Harding, "Stories of change: Faculty in reflective dialogues," in ASEE Annual Conference and Exposition, 2017, doi: 10.18260/1-2--28850.
- [11] Center for Inclusive Teaching and Learning, "Inclusive Teaching," California State University, Los Angeles. Available: <https://www.calstatela.edu/cetl/inclusive-teaching-program> (accessed Sept. 17, 2021).
- [12] Center for Urban Education, "Equity-minded inquiry series: Observations," Los Angeles, CA: Rossier School of Education, University of Southern California, 2018. Available: <https://cue.usc.edu/> (accessed Sept. 17, 2021).
- [13] Center for Urban Education, "Identity in the College Classroom Workbook. Los Angeles, CA: Rossier School of Education, University of Southern California, 2019.



- [14] L. Vanasupa, L. T. Schlemer, and Y. V. Zastavker, "An emancipatory teaching practice in a technical course: A layered account of designing circuits laboratory instructions for a diversity of learners," in ASEE Annual Conference and Exposition, 2020.
- [15] Forney Independent School District, "How We Learn," YouTube, 2016. Available: <https://youtu.be/wlaG99awCD8> (accessed Sept. 17, 2021).
- [16] P. J. Palmer, "The Heart of a Teacher Identity and Integrity in Teaching," *Chang. Mag. High. Learn.*, vol. 29, no. 6, pp. 14–21, 1997, doi: 10.1080/00091389709602343.
- [17] P. Freire, "The banking model of education," *Critical issues in education: An anthology of readings*, pp. 106-112, 2006.
- [18] Eco-STEM Team, "The Eco-STEM Peer Observation Tool," Eco-STEM. Available: <https://ecostem.calstatela.edu/resources> (accessed May 9, 2021).
- [19] C. L. Bowen, S. Heubach, and J. Dong, "Eco-STEM Tools: Changing the Culture of Teaching and Learning in STEM," *Frontiers in Education (FiE) Conference*. Forthcoming, 2022.
- [20] Office of Instruction and Assessment in the Manuel Pacheco Integrated Learning Center, "Peer Review of Teaching Protocol," University of Arizona, 2016. Available: <https://teachingprotocol.oia.arizona.edu/> (accessed Sept. 17, 2021).
- [21] B. A. Israel, B. Checkoway, A. Schulz, and M. Zimmerman, "Health Education and Community Empowerment: Conceptualizing and Measuring Perceptions of Individual, Organizational, and Community Control," *Heal. Educ. Behav.*, vol. 21, no. 2, pp. 149–170, 1994, doi: 10.1177/109019819402100203.
- [22] L. Thompson, "Action Research EcoSTEM," YouTube, 2021. Available: [https://www.youtube.com/watch?v=2bYow1q\\_6-A](https://www.youtube.com/watch?v=2bYow1q_6-A) (accessed May 9, 2021).
- [23] Eco-STEM Team, "Theoretical Frameworks in Educational Research," YouTube, 2021. Available: <https://www.youtube.com/watch?v=FVaBUBW9zTY> (accessed May 9, 2021).
- [24] Eco-STEM Team, "Educational Theories," Eco-STEM. Available: <https://ecostem.calstatela.edu/resources> (accessed May 9, 2021).
- [25] L. Thompson, "Critical Participatory Action Research," YouTube, 2021. Available: <https://www.youtube.com/watch?v=PNSd4fpDtXw> (accessed May 9, 2021).
- [26] C. Lee and S. Johnston-Wilder, "Getting into and staying in the Growth Zone," *NRICH*, 2018.
- [27] C. L. Bowen, L. L. Thompson, G. B. Menezes, and C. R. Nazar, "Work-In-Progress: Measuring Systemic Educational Wellness using the Eco-STEM Educational Ecosystem Health Survey," in ASEE Annual Conference and Exposition, 2022.