Re-Situating the Professional Formation of Engineering Identity

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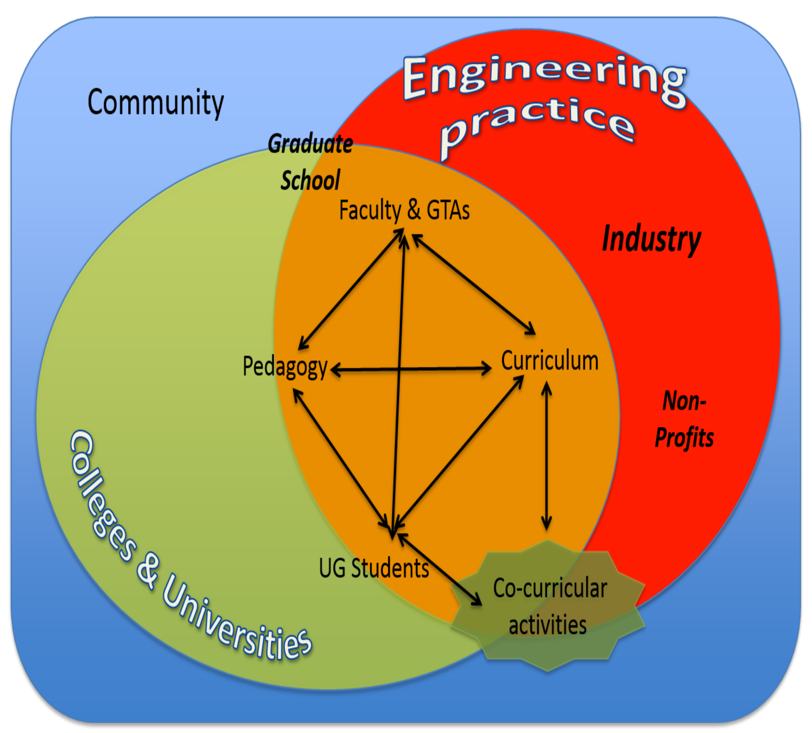
The authors gratefully acknowledge support from the National Science Foundation's IUSE / RED Program under the grant 1519467. Any opinions, findings, and conclusions or recommendations expressed in this material are those of the authors and do not necessarily reflect the views of the National Science Foundation.

Theory of Change

- We use Sawyer and Greeno's (2009) concept of situative learning to "re-situate" current practices in CBEE into the more inclusive, integrated and holistic learning environment that we envision.
- Lasting change requires re-situating and re-negotiating multiple, interacting constituent components, including course design, pedagogies, faculty (and GTA) culture, and student culture.
- Taking a situative approach, we consider activity systems as continually co-constructed through practice, and the parts played in maintaining the systems (and resisting change) by different groups of people, structures, rules, and behaviors becomes clearer.

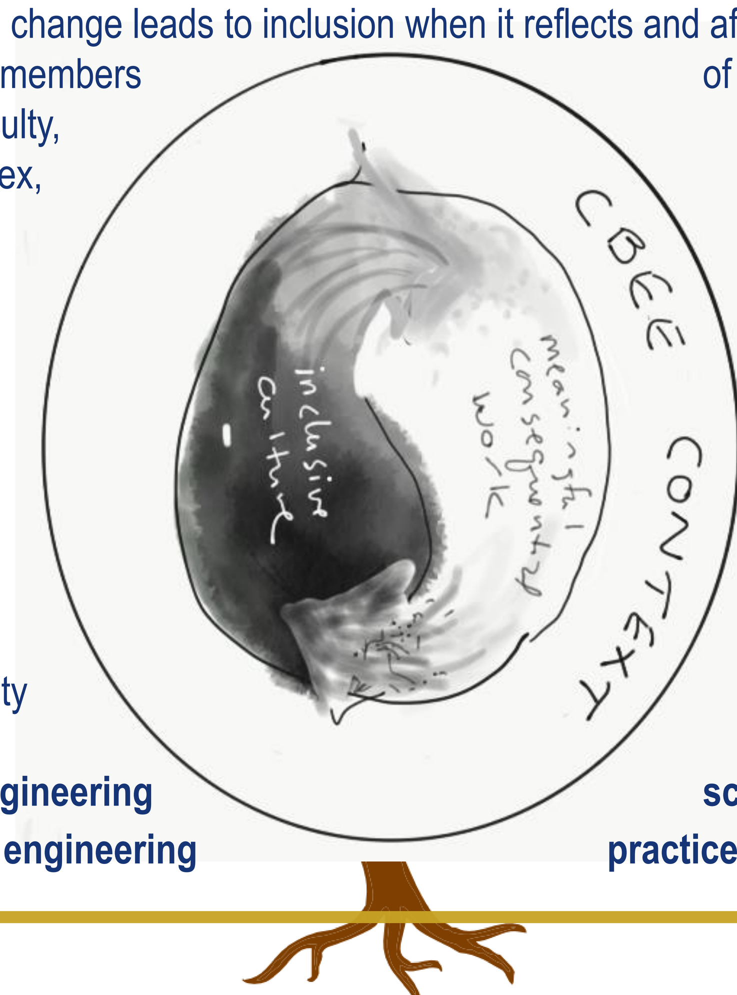
Activity Systems in CBEE



The CBEE *Activity System* contains multiple interacting components.

Mutually Constitutive Elements

1. Increasing inclusivity, diversity, and social justice in engineering education requires active cultural changes at organizational/departmental and interpersonal levels that affect the experiences and perceptions of students and faculty to increase the degree to which diverse individuals **identify as engineers**.
2. Organized cultural change leads to inclusion when it reflects and affirms the lived experiences of all members of the community (e.g., students, staff, faculty, administrators) as people with complex, **multifaceted identities**.
3. These changes should align with our community's core shared mission developing students' **engineering knowledge and skills**.
4. Explicit pedagogical and social supports for students and faculty will help to transition their identities, knowledge and skills **from engineering school world to engineering practice world.**



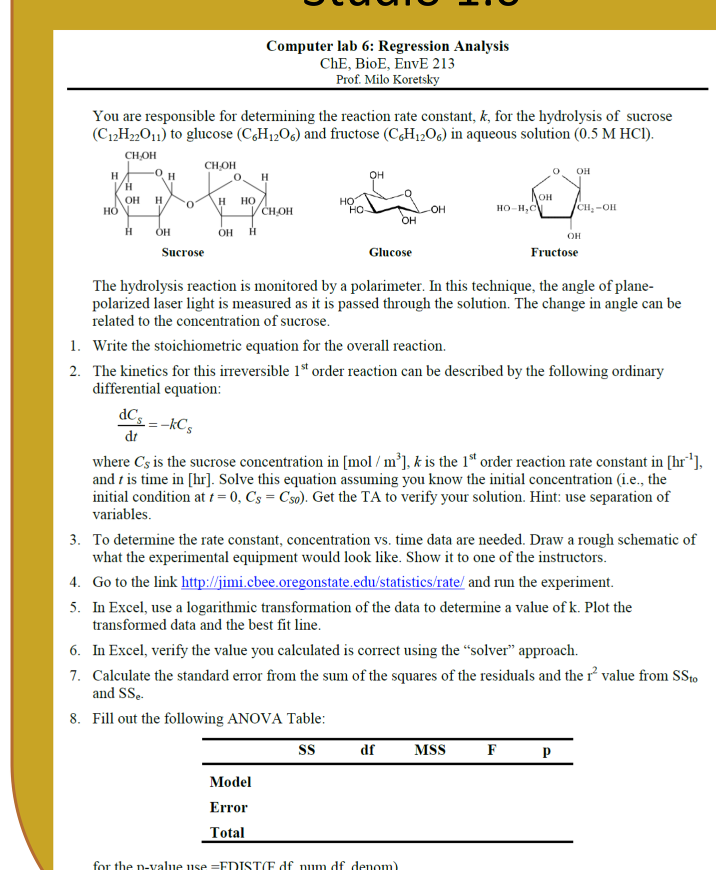
Studio 2.0:

Meaningful, Consequential Learning

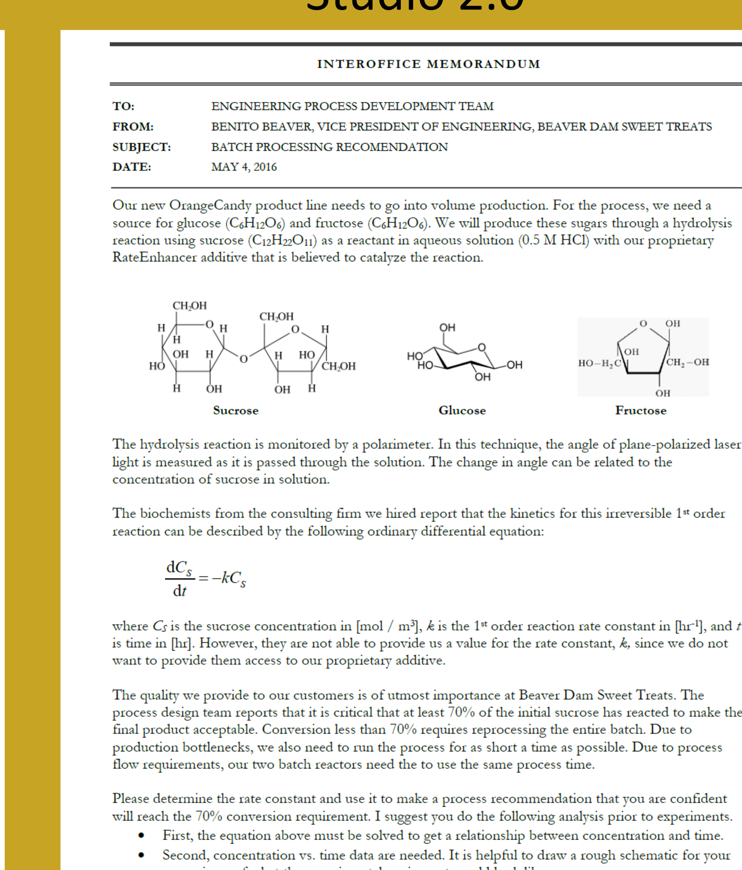
"I had such a great time in studio this morning. I feel like a real chemical engineer for once. I'm proud of my new ability to attack these problems by using my math skills and intuition. I love solving these kinds of problems and am excited for my future.".

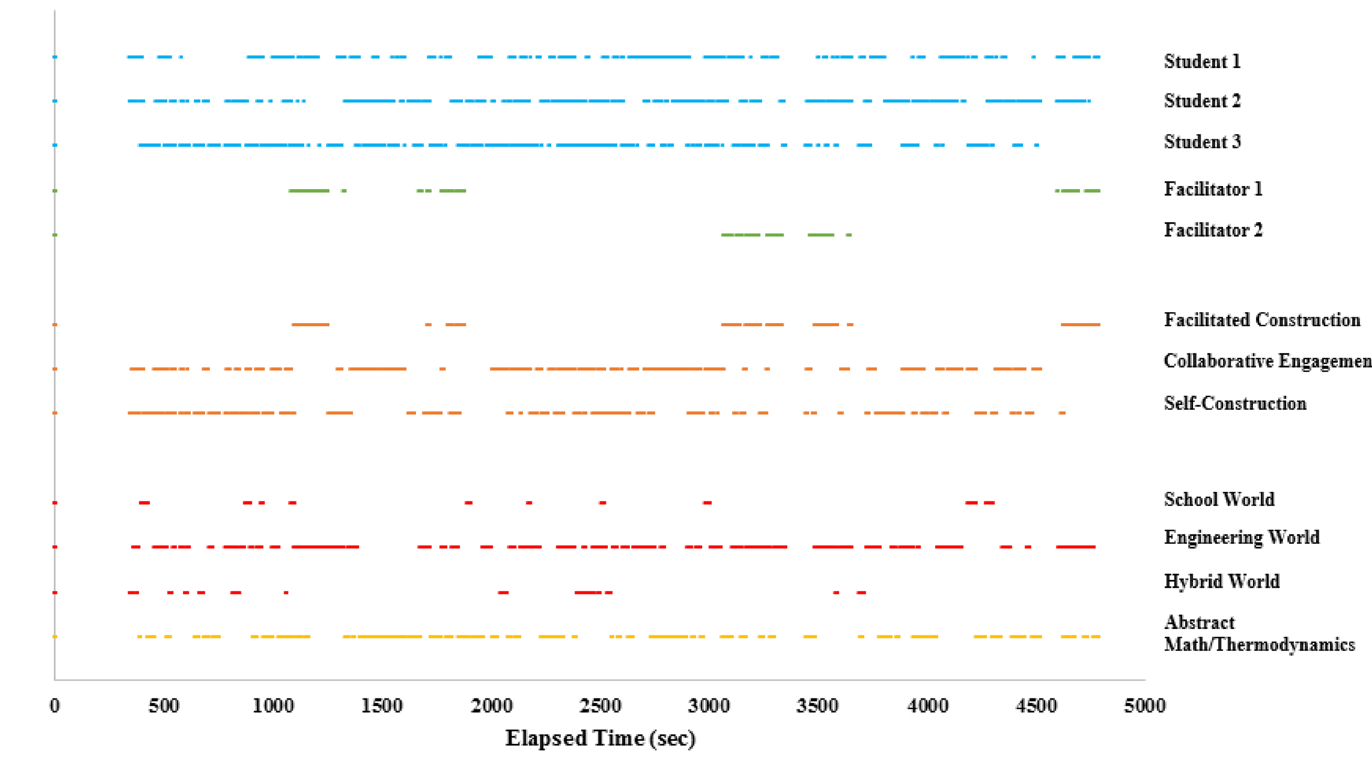
- Student participant

Studio 1.0

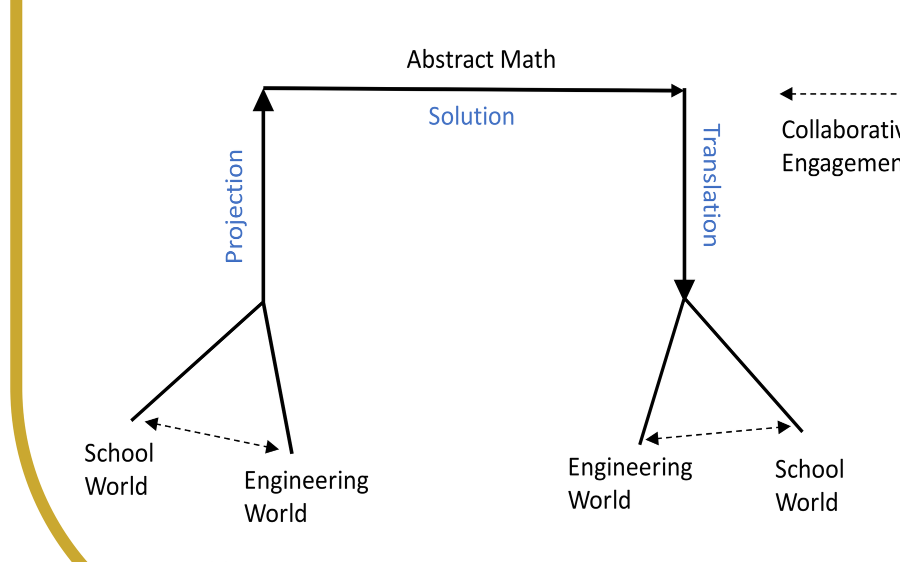


Studio 2.0





Collaborative Engagement Talk Time (sec)					
	School World	Engineering World	Hybrid World	Abstract Math	No Code
Team 1	159	190	76	878	121
Team 2	106	562	109	519	31



- Well distributed dialogue among all members of Team 2 with individual contributions that change with time as students offer their strengths and perspectives is indicative of productive disciplinary engagement during the task. Our data indicates that instances of School World and Hybrid World reasoning do not require this depth of justification or elaboration.

Inclusive Culture

Faculty Development 14 of 29 CBEE faculty have participated in a 60-hour development opportunity directly addressing power, difference and discrimination (DPD) in the classroom and in STEM academic culture.

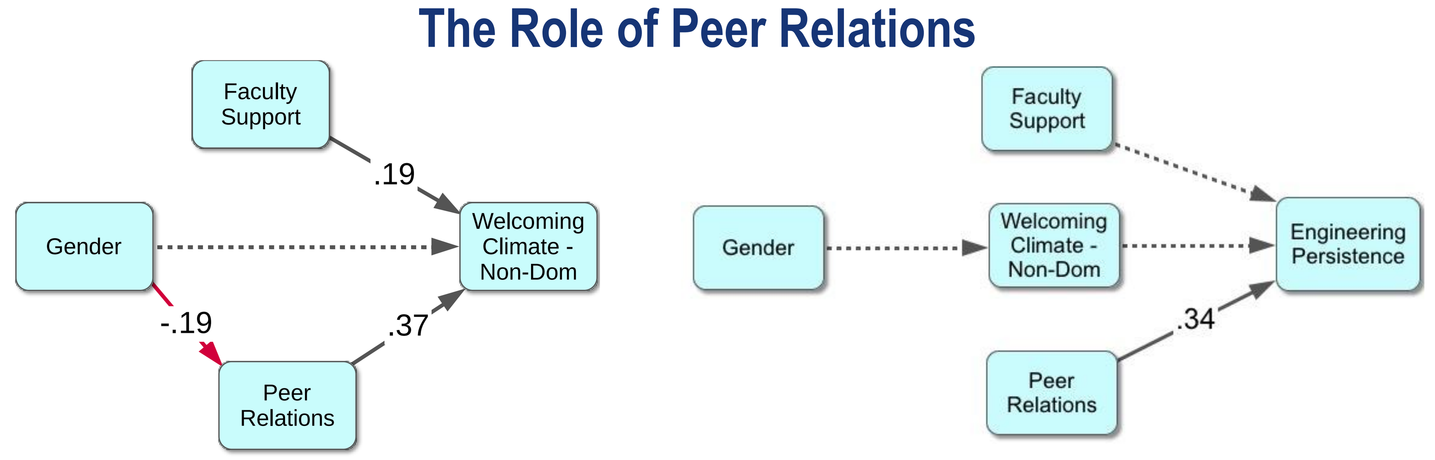
Undergraduate climate survey (N=277)

- Departmental climate perceived as generally welcoming (vs. hostile)
- Students indicated that the climate was more welcoming to men and students born in the U.S. than to members of 12 other identity groups
- Climate perceptions predicted engineering identity and persistence, which were significantly lower for women and students of color
- Women's engineering identification and persistence was mediated by relationships with peers

Undergraduate focus group study (N=56)

- Focus groups investigated students' perceptions of engineering culture, engineering identity, and sense of belonging
- Students generally viewed their unit as a welcoming, inclusive environment
- Many students spoke about experiencing or witnessing bias and/or microaggressions based on social identifications such as race, gender, or nationality
- The majority of international participants and participants of color expressed a lower sense of belonging in the unit

The Role of Peer Relations



Although the departmental climate was rated less welcoming for non-dominant than dominant groups, its effects on women's engineering identification and persistence was mediated by academic and social relationships with peers.

Just Teaming Practices

- Summer 2018: week-long intensive workshop focused on design of Studio 2.0. Efforts included development of team norming practices and group worthy problems.

- AY18: Year-long Community of Practice for CBEE faculty to discuss evidence-based practices of effective team formation, teamwork assessment, knowledge and knowing supporting socially-just teaming practice, and conflict management, among other topics.
- Aspects of implementation of functional and socially just teaming include:
  - Modules for AY 19 designed to critically explore the social and political dimensions of engineering (First-year topics: Personality, role tendencies; implicit bias; conflict modes, tendencies and management; exploration the social and political dimensions of engineering design; and assessment of teaming justice.)
  - Studio 2.0 emphasis is on group-worthy problems (complex enough to benefit from multiple perspectives and various slices of understanding)
  - Development of valid and reliable assessment instruments to measure student competencies in functional and socially just teaming.

distributive justice

informational justice

procedural justice

interpersonal justice