

## **Motivating and Engaging Faculty in Cultural and Curricular Transformation of a Multidisciplinary Engineering School**

### **Prof. James D. Sweeney, Oregon State University**

James D. Sweeney is Professor and Head of the School of Chemical, Biological and Environmental Engineering at Oregon State University. He received his Ph.D. and M.S. degrees in Biomedical Engineering from Case Western Reserve University in 1988 and 1983, respectively, and his Sc.B. Engineering degree (Biomedical Engineering) from Brown University in 1979. He is a Fellow of the American Institute for Medical and Biological Engineering and a Senior Member of IEEE and AIChE.

### **Dr. Michelle Kay Bothwell, Oregon State University**

### **Dr. Milo Koretsky, Oregon State University**

Milo Koretsky is a Professor of Chemical Engineering at Oregon State University. He received his B.S. and M.S. degrees from UC San Diego and his Ph.D. from UC Berkeley, all in Chemical Engineering. He currently has research activity in areas related engineering education and is interested in integrating technology into effective educational practices and in promoting the use of higher-level cognitive skills in engineering problem solving. His research interests particularly focus on what prevents students from being able to integrate and extend the knowledge developed in specific courses in the core curriculum to the more complex, authentic problems and projects they face as professionals. Dr. Koretsky is one of the founding members of the Center for Lifelong STEM Education Research at OSU.

### **Dr. Susan Bobbitt Nolen, University of Washington**

Professor of Learning Sciences & Human Development

### **Dr. Devlin Montfort, Oregon State University**

Dr. Montfort is an Assistant Professor in the School of Chemical, Biological and Environmental Engineering at Oregon State University

# Motivating and Engaging Faculty in Cultural and Curricular Transformation of a Multidisciplinary Engineering School

## 1. Introduction

In an NSF-funded IUSE:RED project<sup>1-2</sup> we are working to transform the culture and curriculum in a multidisciplinary School of Engineering that combines programs in chemical engineering, bioengineering, and environmental engineering. Our work emphasizes instilling a culture of inclusion for all involved (faculty, staff, students) as well as reform of the ‘middle years’ of an undergraduate core curriculum (serving all three majors) so that the student learning experience shifts away from sequestered activities in ‘School World’ and towards more inclusive, realistic and consequential ‘Engineering World’ activities. Cultural change requires recognition that fundamental values, norms, and identities can vary widely among faculty, staff, and students, including differences that align across our three engineering disciplines. In order to ensure success and sustainability of our initiatives, we recognize that shifts in values, beliefs and norms held by our community members are required, as well as changes to long-standing unit policies and procedures. This paper attends primarily to how we are engaging the latter challenge.

### **Background: Institutional Context**

The efforts described in this paper are enabled to great extent by the broader university- and college-level contexts. The most important initiatives supporting work within our unit are highlighted below.

#### *Aligning with University-level efforts*

*Restructuring of Offices.* In the past couple of years, Oregon State University (OSU) has re-envisioned and reorganized many of its administrative offices working in the areas of diversity, inclusion, social justice, equal opportunity, and access so that each office can better focus on its mission and goals. As part of this effort, OSU has established three new positions—Special Assistant to the President for Community Diversity Relations, Vice President and Chief Diversity Officer, and Executive Director of the Office of Equal Opportunity and Access, as well as formed a new Leadership Council for Equity, Inclusion and Social Justice. All of these entities are working collaboratively to bring focused energy to university-wide planning and implementation of equity and diversity efforts.

*Professional Development Opportunities.* While there are many professional development opportunities at OSU in the areas of diversity, equity, inclusion and social justice, three have been particularly useful to our unit’s efforts. First is the Social Justice Education Initiative. This program, launched this academic year, provides all OSU faculty, staff and graduate students the opportunity to engage in an 8-hour, interactive, workshop-based curriculum where participants begin, or continue, their social justice and equity journey. The second is the OSU 60-hour ADVANCE summer seminar, providing a deeper, more immersive experience of these topics for participants. In particular, this seminar is designed for STEM faculty and administrators to examine the complexity of structures, systems, and ideologies that sustain discrimination and the unequal distribution of power and resources within the university. The third is the OSU Search

Advocate training program (10-hours) which provides participants with skills in recognizing and reducing unconscious, unintentional biases, suggests ways to increase the validity of the standard search process, and enhances diversity outcomes throughout the search/selection process.

*The Path to Promotion and Tenure.* In June 2015, the OSU Faculty Senate and President Ed Ray approved changes to the Promotion and Tenure Guidelines to ensure faculty involvement in the University's efforts to be a collaborative and inclusive community. Selected portions of the new guidelines are below.

- “Oregon State University is committed to maintaining and enhancing its collaborative and inclusive community that strives for equity and equal opportunity. All faculty members are responsible for helping to ensure that these goals are achieved.”
- “Stipulated contributions to equity, inclusion, and diversity should be clearly identified in the position description so that they can be evaluated in promotion and tenure decisions. Such contributions can be part of teaching, advising, research, extension, and/or service. They can be, but do not have to be, part of scholarly work. Outputs and impacts of these faculty members' efforts to promote equity, inclusion, and diversity should be included in promotion and tenure dossiers.”

These bold additions to the guidelines address recommendations that resulted from the 2013 Presidential Taskforce Self-Study examining equity, inclusion, and diversity efforts university-wide. In particular, this taskforce along with an outside team of expert reviewers noted that mechanisms needed to be established for valuing and rewarding work in this area and also for holding people accountable to contributing to these broader community goals.

### ***Aligning with College-level efforts***

*Re-visioning of the College Strategic Plan.* In 2015, the College of Engineering (COE) unveiled a strategic five-year plan that included a new goal to “Become a recognized model as an inclusive and collaborative community.” Towards this end, the college recently created an Associate Dean for Faculty Advancement position charged with revising our faculty search practices and evaluating and implementing pre-recruitment strategies, developing and coordinating delivery of new faculty development opportunities around inclusive, equitable and just practices, and ensuring our Promotion and Tenure practices clearly align with the college's values and goals as explicitly laid out in the Strategic Plan. The “messaging” coming from COE leadership has been consistent and ongoing as well, ensuring alignment with our core values (please see McMurtrie, B.<sup>3</sup> for a recent example).

## **2. Approach: School of Chemical, Biological and Environmental Engineering**

Faculty and staff members who engage in School transformation in formal ways need to be assured that their efforts will be recognized and valued through the approbations and reward structure, including promotion and tenure. Our university bases review upon employees' Position Descriptions (PDs). These individualized job descriptions are important in the faculty promotion and tenure process, as they represent a formal agreement between the faculty/staff member and supervisor (school head or department chair) that can be updated and refined at any

time. Other universities sometimes use annual faculty professional development plans, or action plans, for similar goal setting. We are leveraging individualization of PDs and accompanying annual review summaries as tools to engage faculty and staff in reform activities, letting individuals identify and agree upon specific aspects of School-wide work that they are interested in taking on as their own.

In the summer of 2016 we ran two, half-day workshops for School faculty and staff, engaging together in the exploration of two broad questions:

*“What do you [faculty and staff] already do/work on that could be included in your position description that would more clearly illustrate contributions to diversity/inclusion/equity/student success/community?”*

*“What would you [faculty/staff] like to work on in the future toward the same contributions?”*

Note that the workshops were framed within the ‘big picture’ of synergistic priorities and efforts of our college and university, as described above.

### **3. Results**

A main purpose of the summer workshops was to create a faculty and staff driven slate of activities that could then be used by the broader School community for consideration, inspiration, and revision of individual PDs. Workshop results, examples of new initiatives that grew out of workshop discussions, and a look forward to the revision of the unit’s formal annual review structure are each described, in turn, below.

#### ***Summer Workshops***

Twenty-one tenure-track and teaching faculty and staff participated in the two summer workshops, representing 45% of the School community at the time. Each workshop included reading in advance on topics related to diversity, inclusion, equity, and social justice. Most of the advance reading articles were short papers from ASEE Prism for the “Year of Action on Diversity”.<sup>4-10</sup> Participants also read a journal article from Erin Cech that discusses the framing of social justice in engineering education and practice.<sup>11</sup> Each workshop began with a roundtable discussion on personal goals for the workshop, and thoughts stimulated for each participant by the advance readings. We presented a brief overview of definitions for key terms (e.g. diversity versus inclusion) as well as current national thinking on the importance of advancing diversity, inclusion, and social justice in the discipline of engineering. Brainstorming on the two broad working questions listed above was then carried out using think-pair-share, leading into group construction of affinity diagrams (K-J method)<sup>12</sup> on white boards and with Post-It<sup>®</sup> notes.

The two workshops in combination yielded 158 responses. These responses were then sorted into a set of emergent categories that are shown in Table 1. Sample responses are also provided in the table.

Table 1. Categories and example responses from the summer workshops

Category	Example Responses
Leadership	Develop awards for diversity, equity, and inclusion work
	Value/reward extra effort dedicated to enhancing graduate students' professional development
	Give credit for concerted efforts to increase diversity of research groups, collaboration, etc.
Courses and Curriculum	Encourage cross-curriculum teaching of diversity and inclusion issues
	More class discussion, teamwork activities, less traditional lecture
	Create ways to balance the technical and social aspects of engineering work
Co-Curricular Experiences	Serve as the faculty advisor for a student organization that serves people with underrepresented identities
	Lead a service learning opportunity
	Increase student success and retention through undergraduate research
Outreach	Lead and/or participate in broader impacts work (e.g. pre-college or STEM programs)
	Host trainees/students from diversity pipeline programs
	Organize and implement an event to celebrate a particular underrepresented culture in the campus community
Communications	Identify faculty/student/staff who have had various lived experiences to work with students who might have similar issues as "go-to people"
	Model that it is safe to be human with students, have open conversations for authentic relationships with students
	Participate in culturally affirming supportive relationships with advisees/mentees
Graduate Student and Faculty Development:	Participate in diversity and inclusivity training
	Create or participate in workshops on integrating social justice into course content
	Work with faculty, GTA's, and GRA's to develop skills in facilitating group work, progress, and learning
Recruitment of Students and Faculty:	Outreach to community colleges
	Address needs of 2-year transfer students (for improved retention)
	Serve as a 'Search Advocate' on faculty searches
Mentoring of Students and Junior Colleagues:	Increase faculty mentorship of students outside of classroom and lab
	Strengthen mentoring networks for graduate students
	Create/participate in a mentoring network for faculty
Community Building:	Promote an instructional community (e.g. faculty groups discussing instructional practices to support and serve all students)
	Create School activities/events that make groups feel included in our community
	Work with Student Services to offer opportunities to engage international and domestic students with each other

As part of the wrap-up for each workshop, participants were asked to contribute ideas on how "Change Projects" in our unit might be launched and incentivized for faculty and/or staff interested in devoting substantial time and effort to projects in the advancement of diversity, inclusion, equity, and/or social justice. Ideas for Change Project incentives included course/time release, summer salary, budgets for projects, and graduate student support. We also gauged interest and solicited ideas for establishing "Communities of Learning" in our unit. About thirty-three suggestions were received. Topic ideas for Communities of Learning fell into categories that include teaching/curricular, recruitment/retention/mentoring, school climate and faculty community, and communication/authentic relationships. We have subsequently put out a call for Change Project proposals that are now under consideration for support. One proposal, for example, seeks to explore and address the noticeable divide between many of our School's international and domestic students, with the goal of creating programs and experiences that could reduce this gap.

### *New Initiatives*

There are many new initiatives within our School that were motivated in part by the summer workshops. Here we will discuss five such initiatives, each aligned with a particular bulleted item from the list above.

*Enhance Graduate Students' Professional Development.* Four faculty members, four graduate students and one undergraduate student in our School collaboratively developed four 50 minutes modules that would introduce graduate students to the structures, systems, and ideologies that sustain discrimination and the unequal distribution of power and resources in society, with particular attention to how this is operationalized in engineering education and practice. Module content focused on the relevance of difference, power and privilege in engineering, cognitive bias and stereotyping, binary thinking and the conceptualizations of interpersonal and institutional power. Faculty-student pairs delivered the modules in the required School Graduate seminar during winter 2017. While there was a modest assessment of student learning following the fourth module, a more formal assessment and evaluation process will be completed in the coming months. It is expected that the qualitative data generated from this process will inform a thoughtful and strategic re-visioning of content and deliver for entering graduate students during the 2017-18 academic year.

*Participate In Diversity And Inclusivity Trainings, Including Those That Provide Guidance Towards Integrating Social Justice Topics Into Technical Courses.* We are leveraging OSU's Difference, Power, and Discrimination (DPD) faculty development program as well as the OSU ADVANCE summer seminar in order to empower School faculty to engage in culture transformation. These 60-hour seminars are interactive learning experiences centered on analyzing the operations of difference, power, and privilege in higher education, each with slightly different foci. The DPD Academy's emphasis is on critical pedagogies and curricular transformation while the ADVANCE seminar is adapted for faculty in STEM disciplines and provides opportunities to explore structural inequities within the university. To date eight faculty have participated in the DPD Academy and eight have completed the ADVANCE summer seminar. In addition, seven faculty have complete OSU's Search Advocate training program (10-hours). Participants in this program gain skills in recognizing and reducing unconscious, unintentional biases, suggesting ways to increase the validity of the standard search process, and enhancing diversity outcomes throughout the search/selection process (from development of the position description through integration of the new hire into the unit). Finally, three faculty and staff have completed OSU's new Social Justice Education training (8-hours), a program aimed at building a foundational, working understanding of equity, inclusion and social justice among the majority of staff and faculty.

*Support for Equitable Teaming Practices in Studio Courses.* The curricular reform element of our work project specifically focuses on ten core courses that are taught in a "studio" environment where students are placed in small teams for activities.<sup>13</sup> A group of six faculty met in fall of 2016 and developed a set of six instructional design principles for the revised "Studio 2.0." The following two principles specifically address the interaction between the work students do, their support for that work, and inclusive teaming:

- *Group Worthy Problems*: As much as possible, make problems challenging enough so that multiple perspectives become valued. Include some problems that have multiple solution paths.
- *Cooperative Learning*: Retaining the framing of the problem (roles, purposes, context), create a safe learning space that celebrates confusion and shared meaning making. In support, prepare instructors (including GTAs and LAs) to facilitate inclusive interactions and “situate” learning.

We have been looking at norms of interactions in the teams from the lens of status. Essentially, we seek to have teams interact based on what is said rather than who has said it. These studios are largely run by Graduate Teaching Assistants (GTAs) and we are also incorporating undergraduate Learning Assistants (LAs) based on a model developed in physics.<sup>14</sup> It is challenging work for these student facilitators and we are developing structures to support their development. For the GTAs, we implemented a 4-hour pre school-year seminar followed by eight sessions in the graduate seminar described above. The LAs have a separate training initiative with eight hours of pedagogical training concurrent with the first term that they teach. Since the seminar occurs during their teaching activity it is based on reflection in action and reflection on action. While this work has helped align GTAs and LAs to our intent in studio practices, this work is complex and we are seeking ways to further develop this knowledge and skill.

*PLC Work Around Inclusive Teaming.* During the 2017-18 academic year, School faculty members (all of whom will have completed the DPD Academy), will come together in a Professional Learning Community (PLC). PLCs are collegial groups that provide teachers across disciplines facilitated opportunities for extensive inquiry-based faculty development around a focal point. This group’s focal point will be the design of instructional content, pedagogy and assessment metrics for inclusive and socially just teaming practices. In brief, this community will explore scholarship on evidence-based practices for promoting effective and socially just teaming, and use this as a platform for adaptation to our programs. Because our conversations and design will be emergent, it is difficult to provide details of direction. However, questions that motivate this activity include:

*What is inclusive teaming and is that different from socially just teaming practices? What is the motivation (offered to our students and ourselves) for infusing this topic and altered practices through our curriculums?*

*What role does status play in group interaction, i.e., to what degree does an idea depend on who is saying it rather than the idea itself.*

*Is the work “team worthy,” i.e., is the problem / issue presented to the student team challenging enough to benefit from multiple perspectives and various slices of understanding.*

Because the members of this community serve as instructors across all four years of the targeted programs, we will be able to begin implementing our strategy and recording assessment data. We can then refine our process for the subsequent year.

*Include Environmental Justice And Social Justice Issues In Curriculum.* Our School's introductory environmental engineering course was redesigned during the 2016-2017 school year to center on three core concepts. Through participation in the summer DPD Academy the instructor incorporated environmental justice as one of the three central topics, and developed two preliminary learning objectives to guide students' engagement with environmental justice. First, activities were designed to help students identify situations where typical environmental engineering decisions have direct consequences in terms of environmental justice and equity. Second, students were asked to reflect on how and why environmental justice is typically avoided in environmental engineering classrooms. For example, students were often provided an opportunity to resubmit an assignment and correct their mistakes if they also wrote a brief reflection. As one example, many students struggled to calculate the rate of decay of a pollutant dumped into a river. They were prompted to reflect on why so many environmental engineering problems casually reference crimes.

### ***Annual Reviews***

While faculty and staff have begun to engage work that promotes a collaborative and inclusive community, the formal shifts in policies and practices around PDs and annual reviews necessarily lags. At OSU, annual evaluations for faculty and staff are carried out on a calendar year cycle. As part of this review, faculty and staff are asked to reflect on the previous year's accomplishment along categorical areas highlighted in their PDs and to also look forward to expected efforts in the upcoming year. Reviews for the 2016 year will occur in April and May. As part of material preparation for their reviews, faculty and staff will be asked to update or otherwise revise their PDs or to explicitly state plans for their contributions towards cultivating a collaborative and inclusive community in the work they envision for 2017. These plans or changes in PDs will be reviewed and mutually agreed upon with their supervisor (the School Head). For analysis across the School to assess and evaluate trends over time of faculty engagement in the many and varied elements of our work, faculty annual reports and PDs will be anonymized and then evaluated using a two-step coding scheme. We expect that empowering faculty explicitly to devote an agreed upon percentage of their effort to specific work in support of transformation of our school will significantly bolster our progress.

## **4. Summary**

The approaches described in this paper are intended to place responsibility for academic unit culture transformation on each community member as opposed to relying on a dedicated few. We hope that our work will be of interest to and useful as a model for others engaged in similar transformative projects in multidisciplinary engineering schools and departments.

## **Acknowledgements**

The authors are grateful for the enthusiasm and participation in our work from so many members of our School community – students, staff, and faculty. We also acknowledge the support provided by the National Science Foundation through grant EEC 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.



## References

1. Koretsky, M., M. Bothwell, S.B. Nolen, D. Montfort and J. Sweeney. (2016) Shifting Departmental Culture to Re-situate Learning. (2016) ASEE Annual Conference and Exposition. New Orleans, LA. 10.18260/p.26183.
2. Sweeney, J., M. Koretsky, M. Bothwell, S.B. Nolen, D. Montfort, and S. Davis. Re-Situating Community and Learning in an Engineering School. Paper and presentation at the American Society for Engineering Education Annual Conference and Exposition, June, 2017.
3. McMurtrie, B. (2016) How to do a Better Job of Searching for Diversity, *The Chronicle of Higher Education*, September.
4. Reed, T., A. Minerick, A. Olgilvie, M.F. Cox, V. Nelson, Y. Yortsos, N. Latif, T. Wilson, F. Flores, M. Dyrud, B. Mitchell, R.C. Guerra, and G. Crawford. (2014) A Year of Action on Diversity. *ASEE Prism*, September.
5. Minerick, A. (2014) An Unsuitable Job for a Woman. *ASEE Prism*, October.
6. Trytten, D.A., C.E. Foor, T.J. Murphy, R. L. Shehab, S.E. Walden, and R. Pan. (2014) Unseen Differences. *ASEE Prism*, November
7. Moskal, B. (2014) Diversity's Forgotten Dimension. *ASEE Prism*, December.
8. Holloway, E. (2015) What Works? A Culture Change. *ASEE Prism*, January.
9. Groll, L., T. Reed, and M. Cox. (2015) Habitat for Humanity. *ASEE Prism*, February.
10. Riley, D. (2015) A Way Up For Low-Income Students. *ASEE Prism*, March.
11. Cech, E.A. (2013) The (Mis)Framing of Social Justice: Why Ideologies of Depoliticization and Meritocracy Hinder Engineers' Ability to Think About Social Injustices. In Engineering Education for Social Justice edited by Juan Lucena. Dordrecht : Springer.
12. Scupin, R. (1997) The KJ Method: A Technique for Analyzing Data Derived from Japanese Ethnology. *Human Organization: Summer 1997, Vol. 56, No. 2*, pp. 233-237.
13. Koretsky, M.D. (2015) Program Level Curriculum Reform at Scale: Using Studios to Flip the Classroom. *Chemical Engineering Education*, 49(1).
14. Otero, V., Pollock, S., & Finkelstein, N. (2010). A physics department's role in preparing physics teachers: The Colorado learning assistant model. *American Journal of Physics*, 78(11), 1218-1224.