Diversity: a grand challenge in engineering

Diversifying the engineering community at Stanford and beyond

This paper was published in June 2015. The ideas and recommendations within it are among dozens of suggestions that arose from the Stanford Engineering Future process. Share your thoughts with us at SoEFutureFeedback@stanford.edu.
The challenge is clear: There is insufficient diversity in engineering, particularly in leadership positions.

This is true at Stanford, at many other universities and at technology companies, particularly in Silicon Valley. For decades, people have predicted this problem would correct itself over time. Despite many good intentions and substantial efforts to diversify engineering, the issue still persists, and we’re not even close to getting where we want to be, where we need to be.

We need to incite change — in a major way — to diversify the engineering community.

Why is diversity important? There are many reasons, one of which is achieving excellence. To be the best, you need the best people, and the brightest, most talented people come from all backgrounds. Furthermore, if the goal of engineering is to serve people, then engineers need to understand the needs of all people; diversity in engineering is crucial to achieving this mission.

Right now, SoE simply cannot claim to be the best that we can be because we are missing out on talent within groups that are severely underrepresented. While it is straightforward to recognize this issue, it is much harder to address it. Consider the case of new faculty searches: In SoE, faculty searches often yield an applicant pool that exhibits a lack of diversity. How can a department expect to hire a diverse set of faculty if the applicant pool itself is not diverse?

SoE has a number of successful programs and approaches in place to diversify our engineering community. We need to amplify these efforts in a major way. More can be done, much more. We need to build on what we have and develop new approaches to diversify our engineering community at all levels — undergraduate students, graduate students, postdoctoral scholars and faculty.

We must work on diversity issues from both the demand side and the supply side: Let’s aim to retain and recruit (the demand side) to achieve a more diverse SoE community at Stanford while simultaneously working to be the school that aims to diversify engineering (the supply side) at other institutions across the nation.
RECOMMENDATIONS

We recognize that success will not come because of one idea, one program, or one person, but will need to come through many experiments that are prototyped tested and revised over time. The following recommendations provide a first-draft prototype of things to explore. The mandate is to amplify the conversation and start the experiments now.

Share knowledge and best practices.

We need to share best practices across departments and schools as to how to diversify our community at all levels.

We need to find out what’s going on outside of Stanford, the best practices at institutions that are successful at achieving diversity in engineering in academia and in the corporate world. Let’s adopt and adapt best practices to fit our needs.

We need to improve transparency on diversity issues. If we released our diversity information to the public, we could lead the field in making diversity issues front, center and transparent. Let’s use quantifiable metrics and establish a roadmap that we and others can use as we work toward diversity. Particularly intriguing data to report would be those related to the outcomes of faculty searches in SoE, gathering a summary for each department for each search conducted during the past five years. Relevant data could include the percentage of applicants who were female and underrepresented minorities (UM), and comparable data for finalists, interviewees and offers made. This information will put us in a more informed position to develop new ideas that could improve the diversity of our faculty while also making it abundantly clear how much effort needs to be put into addressing diversity challenges.
Our current faculty members should be encouraged to develop courses that serve as workshops for PhD students interested in becoming faculty, particularly women and UM students. For instance:

**A one-unit class could be offered one to three times a year** and designed to be general enough for engineering students across all disciplines. Students might take the course in their second year to begin to understand the general system.

**A one-unit class could be offered once a year** within each department, and be designed to focus on that particular discipline and to be taken after the course above (e.g., the third year in the PhD program).

**A three-quarter sequence of one-unit classes** could be offered to help students prepare their faculty application materials — from their CVs to their research proposals to practice job interviews — perhaps taken in their fourth or fifth years and open to postdocs.

**The classes described here** could be open to all, but with discussion sections for members of particular communities led by faculty from those communities.

**For the instructors,** these courses should count toward the faculty member’s teaching load just as any other class, with any resulting teaching shortfalls covered by SoE.

**Develop workshop courses for potential faculty.**
Establish fellowships, subsidies and cost sharing.

**Fellowships can play a major role** in helping to recruit women and UM PhD students, while also setting them up for successful careers. Creating system-wide SoE offers for PhD admission with an explicit written guarantee of five-year funding is one means to help assuage fears of prospective women and UM PhD students and would help tremendously to diversify our school.

**SoE should work together** with the office of the Vice Provost for Graduate Education (VPGE), whose Diversifying Academia, Recruiting Excellence (DARE) program is highly successful. SoE could potentially contribute resources to the DARE program to help expand the number of awards so that deserving SoE students who might otherwise receive an honorable mention in this highly competitive program can receive a DARE Fellowship. An alternative is for SoE to provide resources for a sibling program — DARE-SoE — for such students, or perhaps in conjunction with the new Accelerator under development (see whitepaper on the Accelerator). Such ideas should be brainstormed directly with VPGE staff who lead the DARE program.

**Fellowships (and subsidies) can also** be excellent vehicles to help diversify the postdoc community at SoE, again perhaps in conjunction with the Accelerator. Achieving diversity in the postdoc community might be more challenging compared with students because postdocs are further along in their careers and more likely to face issues such as affording child care, affording adequate housing for families or trying to balance two careers, especially with regard to gender balance in engineering. We need to support women postdocs so their careers are not competing against child rearing; we need to enable both. Fellowships in conjunction with subsidies for child care and housing can directly help remedy these issues.

**Cost sharing can provide an incentive** for faculty to hire women and UM postdocs to diversify this key group of scholars. Stanford already offers a Faculty Incentive Fund for departments and schools to make incremental appointments of qualified individuals who would bring diversity to the faculty. Creating an incentive (e.g., 30 percent to 50 percent cost share) for faculty to hire women and UM postdocs would have a tremendous impact on diversity in SoE not only from the demand side, but also from the supply side because women and UM postdocs could serve as mentors to Stanford PhD and undergraduate students from their respective communities.
Increase outreach to K-12.

No effort to diversify engineering from the supply side could be complete without outreach to K-12 students. While many in SoE are participating in such activities already, there is significant untapped potential for outreach activities among our PhD students.

**Hiring a K-12 Outreach Director** for SoE could be particularly helpful to coordinate expanded efforts along these lines, working together with Stanford’s Office of Science Outreach.

**Every faculty member in SoE** should actively support their PhD students to engage in K-12 outreach activities, particularly to communities with significant UM populations.

**SoE should provide strong incentives** to faculty, undergraduates, PhD students and postdocs for K-12 outreach. Some examples could include:

- Give course credit (e.g., a one-unit class) for K-12 outreach.
- Consider making the one-unit class a requirement for graduation (e.g., for PhD students). Imagine, for instance, that all or even half of our PhD students completed one or two units of K-12 outreach activities before graduation. This would have an immense impact, considering the hundreds of PhD students participating each year, and fits well within the theme of engineering a better world.
- Offer outreach fellowships for PhD students, a competitive process to cover the tuition and salary for students with strong proposals for K-12 outreach activities that go above and beyond the norm.
Enhance outreach to other institutions of higher learning.

Naturally, there are extraordinarily talented students at the undergraduate and graduate level at institutions of higher learning across the country. Students apply to Stanford for PhD and postdoc positions from many of these schools, but Stanford is less successful at attracting applicants from some institutions, including many with large UM populations. Many such schools have limited resources and do not cover expenses for faculty visitors and seminars. Potential solutions:

**SoE could provide resources** for its faculty to travel to such institutions to build bridges with their communities. This would serve to build a strong professional connection with both faculty and students.

**Stanford could double down** on its Research Experience for Undergraduates and Summer Undergraduate Research Fellowship programs to reach out to women and UM undergraduates from other institutions, helping to diversify SoE in the short term while setting up long-term prospects as well.
Create the right environment.

As important as mentorship and teaching are to this mission, we need to do more to create the best environment possible where our women and UM PhD students feel empowered and excited about becoming faculty. Some thoughts about creating a better environment:

**Showcasing students’ work to help build confidence** while they are in graduate school is also important. Resources should be provided to empower students to create their own sets of lecture series for each community as a forum for giving students positive feedback and building confidence along with building community. SoE should reach out to all the different community groups to ask what we can do to help.

**Resources should be made available** for community-fostering events between students and faculty (e.g., funding for dinners, speakers and special events). These can potentially be through partnerships with existing student organizations on campus for underrepresented minorities and women. In addition to helping expand the incoming pipeline, community-building activities are critical to helping prevent leakage in the pipeline along the way. And partnering with existing student groups can help forge stronger ties with the communities we are trying to support.

**SoE departments should consider revisiting the model** in which graduate students are first admitted into the master’s program rather than directly into the PhD program. Such a conditional welcome with explicit inherent risk probably hinders opportunities to diversify SoE, in particular when stellar candidates are offered admission directly into PhD programs at other institutions with funding packages.

**Build a child care center** within the SoE research core. Many engineering students (at Stanford and elsewhere) believe that having a family and a successful academic career is too challenging, despite the fact that a large portion of engineering faculty have children. This contributes to the lack of diversity in the applicant pool for engineering faculty, particularly among women. Constructing a child care center in the research core at Stanford, as opposed to on the periphery of campus where all are currently located, could improve the situation.

**Studies have shown** that women and UM students are more inspired than the overall engineering pool to pursue engineering for altruistic reasons. We should leverage Stanford Engineering’s goal to create a better world to inspire engineers from all backgrounds to join us and participate in this mission.
We have many possibilities to consider.

The bottom line is that now is the time for us to develop a strategic plan for our women and UM PhD students, then do everything we can to help develop and encourage them to pursue faculty positions and leadership positions within the tech sector.

The best outcome that we could hope for is that other schools emulate what we are doing. SoE can move the needle in the applicant pool so that the percentage of women and UM applicants to faculty positions represents the diverse country in which we live.