Changing the Culture of Engineering at Cornell:
Sloan Foundation Initiatives

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Introduction
The theme for this year’s conference is “Is Systemic Change Happening?” I’m here to answer that question with a “yes”, and to describe the changes occurring at Cornell University. Dr. Ted Greenwood, program officer at the Alfred P. Sloan Foundation, has told us that they are interested in funding activities that will help change the culture of engineering to be more inclusive and open to diversity. Today I will describe how Sloan Foundation grants have played an important role in the changing culture at Cornell.

We have a relatively new Dean of Engineering, John Hopcroft. This Spring he revealed to the staff in student services the college’s new Strategic Plan, which he developed with members of the faculty. It was heartening to see that the very first priority listed is undergraduate education. We have a new incoming president as well, Hunter Rawlings III, and I’ve learned that he, too, lists undergraduate education as his number one priority for the university, a change from his predecessor. In addition, a new position of Assistant Dean of Student Services was created in engineering. This position will coordinate policies and processes within student services, with the vision of becoming more effective in the delivery of services to all of our constituents. Our associate dean will continue to serve in the role of coordinating educational policies and facilitating the faculty–student services interactions necessary for effective student retention, satisfaction, and achievement. All of these factors, as well as initiatives that I will discuss further, position us to be much more student-centered than in the past, which should serve us well as we go into the 2000’s.

Change
During a recent student services directors meeting, our new assistant dean, Deborah Cox, used an overhead with the following statement: “If you keep doing what you’ve been doing, you’ll keep getting what you’ve been getting.” Her purpose was to get us to think about ways we might make changes, to get out of the rut of doing the same old thing because it’s comfortable, so that we get the results we’ve been saying that we want. Rhetoric is easy; actually obtaining the results we say we want takes action. Of course, none of this is new, but it’s important to keep emphasizing the need for change, or we run the risk of falling into, or staying in, a rut. When dealing with issues of diversity, that can be disastrous.

CHANGE: What motivates it? External pressure; pain; conflict; a mover or change agent; technology; continuous improvement process; mandates/regulations; changing consumer or market. I believe one of the most effective motivators is pain—it must be felt personally in order to have change. For example, we all agree that there needs to be an increase in diversity among our students, faculty, and staff at engineering institutions. But
Unfortunately, not all of us feel personal pain or discomfort as a result. However, see an ad on television or in a magazine that shows a beautiful, slim, well-dressed woman advertising a weight-loss product, or a beauty product that will make us look and feel younger, and many of us will feel enough wincing of pain or discomfort to actually consider purchasing the product—and millions do. That’s why weight-loss products, beauty products, and fashion change so rapidly in our society—they know how to get to us personally.

Unfortunately, in many fields including engineering, many members of the faculty and staff, or even students themselves, don’t see the need for diversity as a personal issue—they feel little or no pain as an impetus for change. So what we’ve done at Cornell is begin to raise the temperature. We’re doing this through raising awareness, providing incentives, and imposing penalties—yes, even on faculty.

Some of the activities undertaken in this endeavor have been funded by the Sloan Foundation. Others have been developed, implemented, and sponsored by the College of Engineering. While this talk is about Sloan initiatives, I will also provide the context into which our Sloan initiatives fit.

**Changing the Culture**

In 1991, the engineering college surveyed its students in an effort to discover positive and negative contributors to their experiences as students, as well as to document an aggregate level of student satisfaction. In response to information from the survey, two faculty, staff, and student task forces were established—one to review the curriculum and the other to review quality of teaching and advising. These task forces took their jobs very seriously, and many changes have resulted.

One major change, which is a large step toward changing the culture in engineering at Cornell, was a reduction in the number of courses and credits required to graduate. All other colleges at Cornell require only 120 credits to graduate—engineering was requiring as many as 138, depending on the major (there was a 129 credit minimum, but no ABET accredited major required less than 132). Given the technical nature of the courses, and the already perceived higher difficulty level than most other majors on campus, our students felt overwhelmed and overworked. Beginning in fall 1994, the college now requires a minimum of 123 credits to graduate, with a range from 123–129 depending on the major, with ABET requirements still being met.

Another change that resulted from the findings of the survey were to offer first-semester calculus in small sections, each taught by a faculty member. This changed the format from large lectures of over 200 students to lectures and sections of 25 students or less, with at least one section specifically for students who previously have not had calculus. We now have a math placement exam, where we can use the results of the exam to better place our students in math.

With regard to advising, a new statement on advising was written, advisor training is continually being improved, and a mechanism to assess advisors has been established, similar to the process we have had for years to assess teaching. Awards are being established to recognize faculty for outstanding advising, as we do for outstanding teaching.
Our first Sloan Foundation grant provided funds for the establishment of our women’s program in 1991. They provided support for a freshman seminar specifically for women (as part of our existing engineering seminar program), our tutoring program, our mentoring program, and our newsletter, as well as for the development and implementation of faculty workshops on sexism in the classroom and the development or improvement of courses that would excite students about engineering.

The faculty workshops on sexism were held in fall 1992 and spring 1993. Over 80 percent of our engineering faculty attended one of the six sessions offered. The format used interactive theatre, where the Cornell Interactive Theatre Ensemble performed a scenario of a woman student meeting with her faculty advisor about incidents of sexism that had occurred in one of her courses, taught by a close colleague of her advisor’s. Actual examples of incidents reported by women in the college were used in the scenario. After the scene was performed, the extremely well-prepared actors stayed in character, and the audience asked questions of the characters about their behaviors, feelings, perceptions, and plans for next steps. This was followed by additional processing by a facilitator. While the scenario was hypothetical, the realism was amazing, and its impact intense.

A recent follow up survey of faculty members found that two-thirds thought that the workshops were useful; one-half have thought about them since; one-third have treated women differently as a result of attending the workshop; and three-quarters feel as comfortable working with women as with men. The survey revealed that we still need to work on these issues, and that two-thirds of the faculty would be interested in more information on diversity. This year we plan to develop workshops for faculty that focus on developing teaching and administrative skills, with a significant focus on diversity.

With the course development funds, we have developed Academic Excellence Workshops where women and underrepresented minority students are targeted to attend weekly workshops using collaborative learning techniques in math or physics. In spring 1995 the workshops were made part of the course requirements for all students. Other courses funded were a new course to prepare students without any computer programming experience for our introductory programming course; a new hands-on introduction to engineering course where a CD player is dissected; and changes to five of our already existing introduction to engineering courses to make them more experiential and/or inclusive of women. An introduction to engineering course is now required of all freshmen in engineering. These changes should address one of the concerns of students that they don’t learn about what engineering is until they go into the major, typically in the third year.

Results
Moving toward a more student-centered environment has yielded some positive results. Retention rates over the last four years have improved dramatically. For students who entered as freshmen in 1988 and 1989, 71 percent of the women and 77 percent of the men graduated from engineering. This compares to a graduation rate of 62 percent of the women and 74 percent of the men who entered as freshmen between from 1983 to 1987. Increases were also shown in graduation rates of underrepresented minority students.

Exit surveys for those students who leave engineering seem to indicate a less hostile feeling toward engineering, and a sense that those leaving are moving toward something they prefer rather than away from an unsupportive environment.
I've discussed several of the ways we have raised awareness and provided incentives for faculty. Finally, an example of how penalty has been levied toward changing the culture. This year a faculty member in the college was denied promotion partly because his advising of students did not meet the department's or college's standard. I recall a professor in that same department saying to me four years ago, "Until someone does not get tenure or promotion because they don't advise well, no one will take this seriously." Well, it's time to take this seriously.

Four years ago, I knew he had a good point, and wondered if the day would come when his words would become pointless. Well, the day has come, and only because members of the faculty, staff, administration, and student body were patient yet persistent. It also took perspiration. My advice to anyone who might be frustrated with their "system" and its participants, is "Don't give up!"