

# Diversity in Engineering Education--What Are the Perceived Issues?

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## Abstract

At the Annual ASEE Conference in June 2004, three ASEE divisions--the Graduate Division, Women in Engineering, and Minorities in Engineering--co-sponsored a panel session on "Recruiting and Building Diversity". In this paper we summarize the issues raised by the panel members and by members of the audience in June 2004 as an introduction to a further discussion of diversity, along with a plan for action, by leading engineering educators. Issues of concern at the 2004 session included downsizing and consolidation of diversity programs, providing sufficient mentoring and role models, failure to institutionalize diversity programs, the disparity between students' and advisors' definitions of a "best fit" graduate program, the use of GRE scores in admission decisions, graduate student socialization, and the need for more information on career options early in students' college careers.

## 1. Introduction

The need for diversity at all levels of the engineering profession has been well-documented<sup>1,2,3,4</sup>. However, current enrollment figures for both undergraduate and graduate engineering programs show that, for the most part, women and minorities are still under-represented<sup>5</sup>. At many institutions, especially state-supported universities, tight budgets are forcing some diversity programs to downsize. In addition, at the graduate level, it is highly likely that diversity will also be negatively impacted by the decline in international students, which has been noted in recent years and seems to be continuing<sup>6</sup>. Thus to achieve the desired diversity new strategies must be developed.

Compared to the undergraduate and postgraduate levels, relatively little research has focused on specific strategies for diversifying the engineering graduate student population. In particular, relatively little research has examined the specific social and community needs of graduate students and how to support these needs in the traditional graduate education framework. Related questions about how best to support part-time graduate education and nontraditional students also need to be addressed. One promising ongoing study in this area was described in the panel session on "Recruiting and Building Diversity" cosponsored by the Graduate Division, Minorities in Engineering, and Women in Engineering at the 2004 ASEE Conference<sup>7</sup>. Results from this study should provide much useful information for faculty and administrators concerned about diversity in engineering graduate programs.

Questions and concerns raised by the audience at last year's panel discussion can be grouped into several general areas. These areas can highlight the concerns specific to graduate education and can provide a basis for faculty and administrators to develop effective strategies.

## **2. Areas of Concern**

Based on the discussion at the “Recruiting and Building Diversity” panel session at the June 2004 ASEE Conference, we have identified the following areas as being worthy of more study:

### **a. Graduate School Recruitment**

For underrepresented groups in the undergraduate population, the decision to apply to graduate school is not an obvious one. The importance of providing role models for K-12 students is well-understood. But this has not been emphasized so clearly with respect to academic role models for undergraduates. Indeed, many diversity programs for undergraduates emphasize career skills, internships, and preparation for the job market. While graduate programs are mentioned, it may be that more specific activities could enhance recruitment to graduate programs, for example, shadowing programs for undergraduates and more activities that allow undergraduate and graduate students to interact. In this respect, summer and academic year undergraduate research programs are important, but it may be that they need to provide more explicit career counseling and also to reach out to students who may not volunteer for such programs. Recruiting efforts need to provide information about the entire graduate school experience, not just the academic side of things. And recruiting efforts need to start early. Just as high school students need to know about the importance of taking math and science courses beginning in the freshman year, undergraduates need to be aware of the benefits of graduate school and the need to plan for it early on in their undergraduate years. Undergraduates also need to be explicitly introduced to the detailed career paths that follow from either M.S. or Ph.D. study.

Another area of concern expressed involves advice on which graduate programs to apply to. Several audience members mentioned the idea of a "best fit" graduate program, which would take into account not just academic criteria but also eventual career goals and opportunities for support and mentoring during graduate school. In many cases, most advice a student is given about applying to graduate school focuses on applying to the most prestigious institutions, but there may be other institutions where a fine graduate education can be obtained and where the student is more likely to find the overall graduate experience more fulfilling. Advisors who are well-acquainted with students, beyond classroom performance, would be helpful in mentoring them to choose which graduate programs would truly be a "best fit".

### **b. Admission Procedures**

In many cases, graduate admission committees focus on "hard data", such as GRE scores, rather than looking at all facets of an applicant. This is especially true at large institutions, where the very large number of applications from highly qualified students can be overwhelming. Unlike the undergraduate admissions process, which typically involves a trained staff of specialists, graduate admissions is often a task for faculty committees, and issues such as diversity may be overlooked in the process.

Using GRE scores for women applicants, particularly those who may be returning after a few years' absence, is particularly troubling in light of the fact that research has demonstrated that the GRE has no predictive validity for returning women students: Nearly twenty years ago, a large scale study involving 99 departments and more than 2000 subjects found that there was a "significant under-prediction of first-year grade average for older females in all graduate fields." Returning female students were found to have earned considerably higher grades than all other groups. The study went on to recommend that "graduate admissions committees broaden efforts to identify non-traditional evidence of talent, motivation, and accomplishment in applicants from this group."<sup>8</sup>

Again in 2002, the Educational Testing Service admitted that the GRE underestimates academic success for women, especially those over the age of 24<sup>9</sup>. Yet despite the overwhelming evidence that new measures need to be employed for non-traditional students, especially women, the GRE continues to be the *sine qua non* of admission to doctoral programs in all disciplines nationwide.

At the undergraduate level, schools such as Carnegie Mellon have employed a multifaceted approach to increasing diversity, including curricular changes, and integrating a unit on diversity and gender equity into the teaching assistant training program, emphasizing real-world applications of technology that would be likely to appeal to women students<sup>10</sup>. It is likely that similar strategies at the graduate level would be equally successful.

### **c. A Community of Support**

A continuing concern for all graduate students is how to find sufficient mentoring and role models. This need is not limited to academic subjects. Much more than undergraduate students, graduate students are establishing themselves as independent adults, and possibly taking on family responsibilities. These can be particularly overwhelming for a student who may be far from friends and relatives and who needs advice on how to combine the heavy student responsibilities with other important responsibilities. Advice on how to handle stress is very necessary.

Such a supportive community for doctoral students was initiated at Purdue University in 1999. This pilot project sought to provide support and guidance for doctoral students across campus, especially those whose progress on their dissertations had stalled. Within six months, the group had grown from 4 to 16 members; all but 2 were women.

A newly-graduated doctoral recipient served as the group's facilitator, providing needed information and speakers, and meeting other needs as requested by the group members. Those members having specific dissertation-related problems found a wealth of suggestions from their new support group. Those experiencing trouble with committee members or the university bureaucracy found sympathy, support, and practical suggestions based on others' experiences with the same committee member or other similar problems. Those whose families and/or employers were not supportive of their academic pursuits found a cohort of cheerleaders within the group. Strategies on balancing work and family were also shared. Speakers who had recently completed doctoral programs and graduated shared their strategies for success, offering still another level of support.<sup>11</sup>

Similar groups at other universities are needed to support graduate students through to completion. The ability to be part of a supportive community can make the difference between a successful graduate experience and the alternative.

#### **d. Institutional Priorities**

Additional concerns expressed during the panel session included worries about institutional support for diversity programs. In many cases, students felt that programs were being downsized or consolidated in inefficient ways. Students also mentioned the failure of many institutions to truly institutionalize diversity programs, with such programs expanding and contracting in response to success or failure of external grants, rather than in response to actual student needs.

#### **e. Shared Information**

A useful resource for all faculty and administrators would be a way to share information about what programs work and how to sustain them. Such a resource, explicitly targeting graduate education, does not currently seem to be available. Consolidating what is known would also help researchers to be more aware of what is not known and thus could help to speed up progress in this area.

### **3. Conclusion**

Although some studies of the problems of diversifying the science and engineering graduate population have been done<sup>12,13,14,15,16,17,18,19,20</sup>, much more work is needed in this area. Attracting more of our qualified students to graduate degree programs will require continued effort, but the benefits to the engineering profession will be enormous.

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