



# EEES

Engineering Equity Extension Service

## **CHANGE:** Factors Supporting the Retention/Persistence of Female Undergraduates

### **Introduction**

The overall retention rate of female undergraduates in engineering has been relatively flat or rising slowly for the past decade despite concerted, dedicated efforts at many institutions. One conclusion that can be drawn is that there are entrenched barriers, both institutional and personal, to the retention/persistence of female undergraduates in engineering to graduation. In this issue of *CHANGE*, we identify five factors which may ameliorate certain institutional barriers for female undergraduates in engineering based on a review of programs that have consistently conferred at least 30%, on average, of their baccalaureate degrees to females since AY 2001, the earliest for which these data are available from the American Society for Engineering Education's series entitled *Profiles of Engineering and Engineering Technology Colleges*. The identification of these supportive factors is the first step in changing institutional characteristics that are not supportive of female undergraduate engineering students.

### **Overview of the Research**

The main factors affecting student persistence in undergraduate engineering studies, in general, are self confidence (Felder, *et al.*, 1998; Astin, 1993b, quoted in Besterfield-Sacre, *et al.*, 1997), attitudes towards engineering (Besterfield-Sacre, *et al.*, 1997; Burtner, 2004), quality of instruction (Seymour and Hewitt, 1997; Felder and Brent, 2005), and the quality of the college experience (Burtner, 2004), not necessarily academic ability (Felder, *et al.*, 1998; Seymour and Hewitt, 1997). With respect to female undergraduates, a review of the pertinent literature indicates that persistence is more likely when female students receive the kind of support to which they grew accustomed in high school, such as from key mentors who provide examples and strategies for survival in a male-dominated profession (Seymour and Hewitt, 1997); when the peer group is well represented, lessening the chance of isolation (Astin, 1993a; Tinto, 1993); and when programs

have features that fit well with preferred learning environments for female undergraduates, such as interdisciplinary studies with a stress on the inclusion of liberal arts courses, flexibility, low student-faculty ratio, no pigeon-holing or stereotyping by faculty and fellow students, project and team-based learning, emphasis on design projects (including service learning), and support of innovation and entrepreneurship in both faculty and students. (Blasidell, *et al.*, 1996; Farvardin, 2007; Loftus, 2005; Selingo, 2005; and Vallas and Donohue, 2007) For all students from underrepresented populations, feelings of isolation and the perception of a hostile environment are factors in their persistence. (Hein and Monte, 2004)

### **Factors**

Donohue, Richards, and Vallas (2008) conducted a qualitative review of six engineering programs that met the aforementioned selection criterion to determine the factors the programs had in common which could be verified as fostering an institutional climate, culture, and environment supportive of female retention/persistence. The definitions used in this research are from Battle, *et al.* (2006, p. 64).

The programs on which the detailed analysis is focused are: Alabama A&M University, Normal, AL; Morgan State University, Baltimore, MD; North Carolina A&T University, Greensboro, NC; Prairie View A&M University, Prairie View, TX; Tennessee State University, Nashville, TN; and Tuskegee University, Tuskegee, AL. The main reason for focusing the analysis on these HBCUs is that, of the programs that met the selection criterion, they have been able to graduate female undergraduates at roughly the same rates with fewer resources, allowing for identification of factors that are both successful and achievable.

The five factors are: size matters; *everyone* is committed to student success; teaching is valued in the institutional culture; public presence of female faculty; and an affordable educational experience.



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Initial research results indicate that these factors enable success in retaining female undergraduate engineering students in all disciplines, not just in the disciplines that could be characterized as “female friendly.” This outcome is important, given that female graduates are grossly underrepresented in the disciplines of electrical and computer engineering, mechanical engineering, and computer science: disciplines in which the great majority of undergraduate engineering degrees are awarded. (Gibbons, 2007)

## Recommendations

Based on the research, recommendations for *CHANGE* include the following:

- Provide small-scale, student-oriented experiences for students across the board
- Provide “consistency of care”
- Have institutional culture, climate, and environment accurately depicted in recruitment literature so students can determine whether a given program is a good “fit”
- Make a program-wide commitment to fostering a “community of care.”

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*CHANGE* – Change and Awareness Necessary for Global Engineering

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