# Tackling the Engineering Resource Shortage in the South: How Can We Attract and Retain Women to Engineering?

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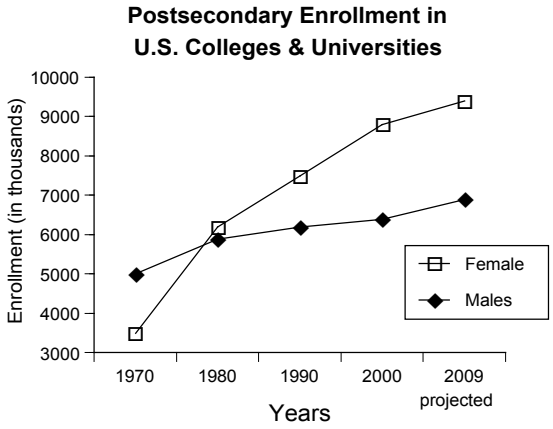
Abstract:

How should universities handle the shrinking number of females entering their engineering programs? What are the obstacles unique to the South that face college administrators? These are important questions that need to be addressed.

Recently, the Southeast Conference (SEC) universities have formed a coalition to establish a dialog among the SEC engineering schools. One goal of this coalition is to share experiences and concerns regarding diversity in our programs. Together we will identify important, common, unresolved problems associated with this issue, as well as identify collaborative efforts to resolve these problems and the "deliverables" resulting from our efforts. This alliance, entitled the "Diversity Program Alliance", in its infant stage right now, is plagued by many societal influences unique to the South. The University of Kentucky, a large public land grant university, and a member of this alliance, plans to look into how women in engineering programming is handled at other SEC campuses, and work toward collaborative programs which will enhance all SEC campuses.

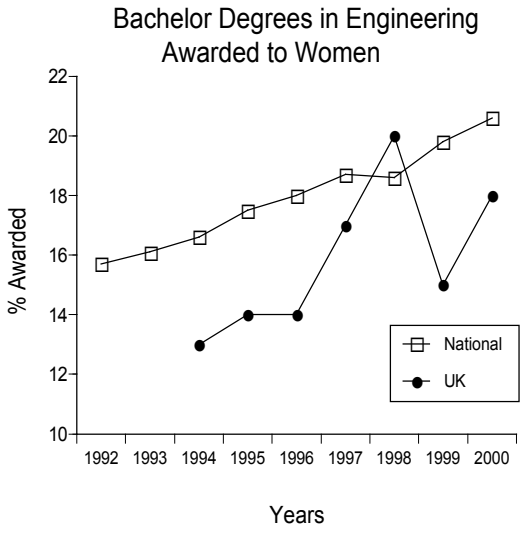
Overview/Related Literature:

Women are entering colleges and universities across the country in record numbers – surpassing the enrollment of their male counterparts. This is great news, as women are reaching the level of education where they can benefit from the full range of educational and economic opportunities available to them. In 1999-2000, 57% of all degrees earned in the U.S. went to women.. If this trend persists, women will obtain 59% of the bachelor's degrees by 2010. As indicated in the graph below (Graph #1), the total number of women enrolled in postsecondary education in the U.S. surpassed the number of men around 1980. Women enrollments have increased significantly faster than men's since the 1970's. By 2009, 2.5 million more women than men are expected to enroll in our nations two and four-year institutions *(8)*




**Graph #1**

Although women are entering college in large numbers, they are not selecting the STEM fields of study (science, technology, engineering and math) that historically gender the higher salaries. The number of engineering degrees awarded nationally to women in 2000 was up 1% from the 1999 figure. *(9)*




**Graph #2**

Select engineering colleges from within the Southeast Conference (SEC) universities are also facing low female enrollment and graduation figures. Alabama, Arkansas, Auburn, Kentucky, Louisiana State, Mississippi, Mississippi State, South Carolina, Tennessee and Vanderbilt are working hard to recruit minorities and women to their engineering programs. The Associate Deans of these SEC universities have formed a coalition to establish a dialog among their schools. They are sharing their experiences and concerns regarding three important issues: diversity, foundation/first-year, and information technology. They are attempting to identify

important, common, unresolved problems associated with each of these issues. By sharing experiences, coordinating efforts, and developing long-term relations, these universities hope to address these problems. Following their lead and focusing on diversity, a "Diversity Program Alliance" was formed consisting of minority and women in engineering program administrators and other student support personnel. Although this Alliance is still developing, the administrators all agree there is much to be done to increase the numbers of women and minorities studying engineering on their campuses. Initial review shows that currently there are no formal Women in Engineering Programs in the Southeast Conference universities. Although outstanding programs addressing women in engineering do exist in these SEC universities, they are offered under the direction of Student Services or Diversity in Engineering programs. Minority in Engineering programs (MEP) do exist at the majority of these institutions. In this instance, University of Kentucky is clearly a leader among the SEC universities, but how does it compare nationally?

Recruitment and retention of women in science, technology, engineering and math (STEM) disciplines has been a major focus of universities across the country, and is mirrored at the Southern Regional level. Specifically, consider the case at the University of Kentucky, where bachelor's degrees were awarded to 1,504 female students in 2001, accounting for 50% of the graduating class. In the same year, the UK College of Engineering awarded 355 Bachelor of Science degrees. Only forty-eight female students (14%) were among this group. Also included in Graph #2 are percentages of UK College of Engineering graduates from 1994 -2000. In comparing these percentages of women graduating nationally and at UK, it is important to note that the national figures include majors such as industrial engineering and biomedical engineering, which normally attract large percentages of female engineering majors

What is the status of women in the state of Kentucky? What are the issues that are obstacles to the economic progress of Kentucky women? According to the Kentucky Long-Term Policy Research Center (2000) Report, *education* is the critical factor "that will determine Kentucky's success in meeting the challenges for the next century". In the Status of Women in the States 2002 Report, published by the Institute for Women's Policy Research, Kentucky was ranked 3rd worst state for women. In addition, a well-regarded gauge of the state's economic performance in the "New Economy" is the Milken Institute's New Economy Index which ranked Kentucky 44th overall in its 2001 survey. Contributing to this lagging performance is Kentucky's persistently low educational attainment particularly in the areas of science and engineering. (*3) To* address this problem, Kentucky Governor Paul Patton took action in 1997 by enacting the Postsecondary Improvement Act of 1997. This Act dramatically changed the focus of postsecondary education in the Commonwealth of Kentucky. Emphasis was placed on assuring that Kentucky's postsecondary education and technical education system was positioned to provide the human capital needed to allow the Commonwealth to be a leader in the global economy of the 21st Century. Education became the mantra for the state of Kentucky – in fact, the Governor's motto is "Education Pays". Education is the key to lifting families out of poverty, ensuring that women's contributions are valued, improving health and well being, and increasing political preparation. The focus was a change in cultural attitudes coupled with the constant pressure to improve the quality and availability of education to produce the intellectual pool necessary to support a high tech, innovation-based economy in Kentucky.

How is Kentucky addressing this challenge? Kentucky cannot move forward without addressing the challenges and barriers that keep women from achieving economic self-sufficiency. Education is the key. Although the state has made improvements in its public schools and colleges, the resources of Kentucky's educational system are underutilized. In November 2001, Governor Patton appointed a 47 member *Governor's Task Force on the Economic Status of Kentucky's Women*. On December 4, 2002, the following preliminary findings were released.

- Too many Kentuckians are undereducated and inadequately prepared for postsecondary education: This is truer for females than males. While more women than men are graduating from Kentucky schools with associate, baccalaureate, and master's (excepting MBA's) degrees, more men earn professional degrees – those earned from dental, medical and law schools. In addition, the majority of women's associate, baccalaureate, and master's degrees are in fields that prepare them for lower-paying jobs.

- As of 2000, only 17.8% of Kentucky females 25 years or older had completed four or more years of education compared to 23.6% nationwide *(5)*

- While the percentage of African-American with high school degrees in Kentucky (77.2%) is comparable to both white students (78.7%) and to national averages (78.9%), only 5.7% of African-Americans, compared with 16.6% nationwide, had earned a bachelor's degree or higher *(2)*

- Gender differences are significant when students taking the ACT on 2001 were asked to declare their expected college major; 16.7% of the 16,669 girls in Kentucky who completed the ACT in 2001 declared a STEM major, while 40.8% of the 13,280 boys in Kentucky who completed the ACT in 2001 declared a STEM major *(6)*

- Half of the households headed by women in Kentucky have annual incomes of less than $15,000 *(6)*

- "Women with bachelor's degrees are paid $34,000 a year on average—about $14,000 less than men with the same level of education. Women with doctorates are paid a little less than $67,000, compared with more than $112,000 for men" *(6)*

- Kentucky has too few "quality jobs that lead to self-sufficiency, even for women with college educations*"(6)*. (7)

With these facts and figures in mind, how can the University of Kentucky tackle the job of recruiting and retaining women and minority students in engineering in Kentucky? We find ourselves dealing with difficult problems associated with the societal and economic climate in the South. With this background in mind, here are programs with their unique slants addressing southern influences:

**WIE Welcome Retreat**: Entering female students spend the day "discovering engineering" before classes begin. They are introduced to other female students; interact with women faculty and graduate students. This "head start" program also provides female students time to meet with other "new" female student in engineering developing relationships before school begins. Developing relationships with women faculty is highlighted. "Engineering schools with high numbers of female students say the best, albeit the most obvious, way to attract female students is to increase the number of female faculty members" *(5)*

**E-Mentoring Opportunities**: "MentorNet®", the national electronic industrial mentoring network for women in engineering and science, offers UK undergraduate students the opportunity to be paired with female or male engineers across the country. Mentors offer support and provide encouragement to students as they progress through their coursework, and prepare to embark on their professional careers. Mentoring has been found to be an important factor is keeping students in engineering. Students are most likely to drop out during their first year in college, and mentoring is key to retaining students. Dr. Carol Muller, MentorNet Founder, states, *"Having a mentor who is working in industry can greatly influence a woman student's understanding of a field and her knowledge of opportunities available after graduation, and a mentor can provide advice, support and encouragement to help a student persevere. Students who have participated in the MentorNet program report bolstered self-confidence and increased dedication to their field of study. There is compelling evidence that mentoring can make a big difference in a student's success. While she completes a degree program, as well as after graduation, professional contact can definitely help them overcome gender related obstacles that they face while in college and later in the workforce."* In 2002-2003, eighty University of Kentucky students were matched with e-mentors.

**Residential Hall for Women in Engineering**: The "WIE WING" is located on the first floor of Blanding III, one our residence halls. The purpose of this special community of female engineering majors is to provide them with a supportive environment that offers opportunities for formal and informal interactions with faculty members and engineering advisors. Female students have an opportunity to join study groups, take classes together and participate in activities designed to enhance learning and exploration of career opportunities. New in Fall 2001, is the **"Engineer in Residence"** program. Students living in Blanding III will have the opportunity to interact with an electrical engineering graduate from the College of Engineering now employed at Lexmark, International in Lexington, Kentucky. Evening programs are offered to support and encourage all dorm residents. Learning communities have shown to be very successful in retaining students.

**Undergraduate Research Program:** The Undergraduate Research Program creates research partnerships between first-and second-year students and faculty researchers. The program offers students the opportunity to work and learn along side a research faculty. Undergraduate students are given the real-life experiences of working in laboratories; developing a research abstract; presenting their projects at symposiums and professional conferences; publishing their findings; and meeting others in the international community of scholars.

The College of Engineering has been collaborating with the **Young Women in Science Summer Program** over the past two years**.** This summer camp targets young female students

from Appalachia encouraging them to pursue scientific and engineering careers. The students are mentored throughout the school year and also participate in workshops held in their hometown community colleges. We have also offered to assist Murray State University with their summer program, **Project Open Doors**, for middle school minority female students. This program encourages these young students to pursue science, mathematics, engineering and technology careers.

**EGR 101: Introduction to Engineering**: This first-year course introduces the engineering profession and the skills and expectations required for success. The course consists of a three-hour lecture and a three-hour laboratory providing students with an increased appreciation and understanding of the engineering profession and its many disciplines. Students develop fundamental engineering laboratory skills, practical experience in engineering design and problem solving, familiarity with the computing environment, as well as software applications commonly used in engineering courses. Female students do exceptionally well in this course due to the hands-on component. Also, female students are attracted to the small group problem-solving teamwork.

**Society of Women Engineers (SWE):** Members of SWE participate in a variety of activities to educate others about engineering, to recruit students to UK, to help students develop professionally, and to support their peers. Membership offers opportunities in developing friendships, networking, leadership skills, community contacts, and exposure to industry. Student members of Society of Women Engineers (SWE) work closely with the Women in Engineering (WIE) Program activities by volunteering their time as mentors and role models. Without this partnership, these programs would not be successful. SWE's award winning program offers students the opportunity for involvement in the following programs: SWE Buddy Program, Outreach Activities, Community Service Activities, Team Tech, Tutoring, and Career Fair Task Force to name just a few. Involvement in SWE has shown to be a key factor in keeping students at UK. **Phi Sigma Rho**, a national sorority for women in engineering provides a network of academic supports and encouragement for our female undergraduates. The UK Chapter was establish in 2002, and has been very successful in attracting and retaining students in engineering.

Conclusion:

With increased numbers of female students entering colleges/universities in Kentucky and across the nation, it is so important that institutions of higher education publicize their existing programs and opportunities to women to broaden their career opportunities. It is a fact that parental, educational, and societal influences often have a negative impact on gender roles as evidenced by girl's career choices, i.e. (nursing, education) in Kentucky and across the nation. Together with the other SEC schools in our "Alliance", future plans might include an educational campaign to teach the economic and societal benefits of careers such as computer science and engineering.

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Biographical Information:

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