

Attracting Undergraduate Science, Mathematics, & Engineering Majors

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There has been much recent discussion about what can be done to attract more students into the sciences (for the purposes of this document, *science* is broadly defined to include mathematics and engineering as well as the physical and life sciences), particularly women and minorities. A new study by the Higher Education Research Institute (HERI), profiled in *The Scientist*¹, found a 40% decline in the number of undergraduate science majors between the first year and senior year. In other words, only 60% of the students that intend to major in the sciences complete their studies in science, math, and engineering (SME) fields. This study found that "students' choices of SME majors, their success with those majors, and their eventual career selections all depended heavily on peer influences." Another factor cited was the quality of precollege preparation. Highly competitive programs, while successful in terms of knowledge attained, discourage students from remaining in engineering and science.

What can be done to change the current environment for undergraduate students in the sciences? Are there tools that individuals can use to combat the present system with its "weed" rather than "seed" mentality?

I would argue that one of the most effective, and least understood, methods is mentoring. I define mentoring as the informal mechanism by which students learn the structure and the function of the scientific establishment. It is an ongoing, multi-faceted process that complements the formal components of education and training encompassed in course work and instruction in laboratory methodology and techniques.

¹ Hoke, Franklin. (1993, January 25). Study sees alarming science dropout rate. *The Scientist*, 7(2), pp. 1,4.

For the past three years, through a generous grant from the Alfred P. Sloan Foundation, the Association for Women in Science

(AWIS) has conducted a mentoring project for undergraduate and graduate women science students through its 50 chapters located nationwide. AWIS is a 22 year-old, non-profit educational organization that strives to improve education and employment opportunities for girls and women in all science fields. Over 60% of the AWIS membership hold doctorates in their fields. The purpose of the project is to counteract the many factors that discourage students and decrease their retention in the sciences.

The Sloan Mentoring Project includes one-on-one mentoring, small group discussion meeting, large workshops with prominent speakers, scientific poster sessions, laboratory experience, and exposure to scientific conferences. AWIS is in the process of formally evaluating the project through extensive surveys of all participants (including mentors, mentees, and program coordinators), in addition to a more in-depth study of four "core" chapters using focus groups. The four chapters -- Philadelphia, Gulf Coast--Houston, West Virginia, and Palo Alto -- were selected for their excellent programs as well as for population diversity.

The following are some preliminary findings of this project, including features and considerations essential to an effective mentoring program.

The students surveyed were asked what was the **most** important factor in their decision to study science. The most common response (47%) was "science is enjoyable and interesting." The factor ranking second, at 12%, was "science is challenging." Interestingly, the third factor was "a teacher encouraged me," at 10%. An obvious thought is that if this survey is a correct indication, almost half of the female student population's prime motivation in entering scientific fields lies in experiencing enjoyable, interesting, and challenging science. Unfortunately, many of our first-year science classes and laboratories do not meet these criteria.

The students were asked to describe the life pattern they would prefer ten to fifteen years from now. 83% responded that they envisioned themselves married. Most students, 51%, foresaw having two children. 83% of the students wanted a full-time career, with 85% responding that their partner would be employed full-time as well. If you take this data and refer to Elaine Seymour's research, which

found one of the reasons for women leaving SME majors to be a "rejection of the lifestyle implied by particular SME careers,"² you can see why it is important for budding women scientists to be exposed to established women scientists who have dealt with balancing family/career issues.

The issues covered in the mentoring program were diverse. The following were the top concerns expressed by the students:

- o career opportunities and options
- o academic course selection
- o research opportunities
- o networking and professional contacts
- o self-image and self-confidence
- o balancing family and work

76% of the students who responded reported that they perceived barriers to entering and staying in the science careers for women, while 61% reported that the AWIS mentoring program helped them to address these barriers. This was accomplished through identification of barriers, career advice, reaffirmation that students were not alone in their experiences, and through contact with women who have broken through those barriers.

Of the mentors participating in the project, the majority felt that they were effective or very effective as a mentor. During the academic year, 47% of the mentors met with their students between 2-5 times, the highest percentage reported, though one must consider that these surveys were conducted mid-year, and there may not yet have been time for multiple contacts. The second highest response, 14%, was 6-10 contacts thus far. Anecdotal evidence from our programs emphasizes that the following are necessary components in any mentoring program:

- o Mentors must take the initiative in beginning the relationship. Training programs for mentors are helpful; of those mentors trained, 80% responded that training was useful.
- o An informal event, such as a fall open house, helps create a hospitable

²Seymour, Elaine. (1992, March/April). Undergraduate problems with teaching and advising in SME majors -- Explaining gender differences in attrition rates. *Journal of College Science Teaching*, XXI (5), pp. 284-292.

environment to begin mentoring relationships.

- o Gather input from students on optimal times, places, locations, and topics for mentoring programs.
- o Aim for a balance between structured and unstructured sessions. For all meetings an "Eat, listen and discuss, and eat again" formula is extremely popular with students.
- o Finally, enlist the support of your administration. In-kind contributions, such as copying privileges and facility use, are important in creating a climate in which mentoring can flourish.

AWIS, realizing that not all students are near an AWIS chapter, has published a paper mentor, A Hand Up: Women Mentoring Women in Science. The first section of the book, titled "Voices," includes interviews with individual women scientists at all stages of the career ladder, from undergraduate students to notable scientists such as Jewel Plummer Cobb and Rita Colwell. It is followed by a consensus piece that analyzes what these women have in common and how they responded to the challenges presented to them. The third section is an "Advice" portion that includes material on all the vital yet hard-to-ascertain information one needs. For example: How to get into graduate school, presenting papers at conferences, and landing your first job. The book concludes with a comprehensive listing of federal and private organizations that support women in the sciences. The book is available for \$20.50, with a special price of \$16.50 for AWIS members. Call 800-886-AWIS for more information.

It is our hope that the establishment of mentoring programs throughout institutions of higher education will create a climate that encourages and rewards not only productivity in research, but good teaching and diligent stewardship of our emerging scientists.

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