THE WOMEN IN SCIENCE PROJECT AT DARTMOUTH

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The Women In Science Project at Dartmouth College comprises a comprehensive set of programs and activities designed to encourage first year undergraduate women to pursue their interests in science, including math and engineering. It was piloted during the 1990-91 academic year. Components include research internships, special science seminars, panel presentations, discussion groups, career workshops, industrial site visits, and a regular newsletter. This paper briefly outlines the problem presented by women's underrepresentation in the sciences, considers its origins, describes a new initiative at Dartmouth designed in response -- the Women In Science Project -- and offers a preliminary report on the project's progress and success.

A National Problem

The need to encourage the study and pursuit of careers in the sciences is pressing. The National Science Foundation predicts a shortfall of 400,000 bachelor's degree recipients in the natural sciences and engineering by the year 2000. Industrial leaders and policymakers have pointed out the national and worldwide need for more scientists and engineers. In addition, our democracy requires informed citizens, too few of whom have enough knowledge of basic science to contribute to policymaking in effective ways. Women are greatly underrepresented in scientific fields; nationally, they represent only 16% of scientists and less than 5% of engineers. Not only are women a potential source of additional labor supply, but they deserve access and opportunity to pursue rewarding scientific endeavors. The Women In Science Project was designed in response to these needs and to test strategies for future efforts to encourage retention of all students studying science.

Origins of Women's Underrepresentation

If we want to encourage the retention of women in the sciences, we naturally turn first to the reasons they leave the sciences. Numerous explanations have been offered, some unique to women, but many operative for a good portion of men, too.

A number of factors contribute to fewer women studying and pursuing careers in the sciences. Early socialization, in families, in schools, and in other media and institutions of children, often leads to an internalized assumption that science is somehow less appropriate for girls and women than for boys and men. Conversations with college women suggest that schoolgirls are still sometimes counseled to avoid science or scientific careers; the pursuit of science may be perceived or portrayed as
isolated, lonely, and incompatible with marriage and childrearing. There are still comparatively few role models for women in science, leading some girls and women to conclude that scientific pursuits are less appropriate for women. Though models and mentors need not always be of the same gender, the lack of role models who combine the roles of successful scientist and mother can be discouraging to aspiring scientists. It has also been suggested that some girls' early socialization and education give them fewer opportunities to "tinker" and explore machines, equipment, and nature, resulting in less ease and confidence in experimental and laboratory work. Also as adolescence develops, some girls are more likely to suffer from low self-esteem and more likely to internalize failure, and are thus less likely to persist in an area in which they have not been particularly encouraged.

Coupled with these phenomena of socialization are the active barriers to women in science in higher education and in careers. Overt, subtle, or inadvertent gender discrimination and lower expectations for women on the part of faculty, students, graduate student teaching assistants, administrators and prospective employers all may contribute to a discouraging environment for women interested in science. Actual classroom experiences also may contribute to fewer girls and women pursuing science. The "chilly climate"2 of some classrooms and workplaces for women discourages some from continuing in science. Research has shown that women are more likely to be interrupted than men, people are more attentive when men speak, men are more likely to get more attention, praise, criticism, and feedback than women. In addition, the extreme underrepresentation of women in some scientific fields and specialties makes them more likely to be viewed as tokens, seen in relationship to stereotypes about women, subject to greater scrutiny, and socially and professionally isolated,3 hindering their progress and discouraging them from continuing to work in these fields.

In her 1990 monograph, "They’re Not Dumb, They’re Different: Stalking the Second Tier,"4 Sheila Tobias suggests that many of the dynamics of introductory science and math courses in college serve to discourage students, women and men, from further study. For some able and talented students, the competitive, rather than cooperative, nature of these classes, the lack of connections to history, philosophy, and applications, and the close-ended nature of homework, tests, and other assignments make these courses dull, unappealing, and uninspiring in comparison to other areas of study.

It is important to reiterate that though some of these factors may impact more girls and women than boys and men, most affect some students of both genders. Some individuals appear not to be affected by these phenomena, and others may be unaware that their interests have been shaped by external factors. In designing Dartmouth’s Women In Science Project, we intentionally incorporated a wide variety of strategies under the broad umbrella of the initiative. Solving the problem of women’s underrepresentation in the sciences will not be easy, nor does it lend itself to one “quick-fix” solution. Women are not all alike; they leave the study of science for various reasons, different from one individual to another. No one strategy will work for all. Since many of the reasons women leave the study of science are the same reasons men leave the study of science, we can anticipate extending effective strategies for retention to programs for all students.
Dartmouth’s Response to the Problem

Dartmouth is a small liberal arts university, founded in 1769. Its student number about 4200 undergraduates, and about 800 graduate students in masters and doctoral programs in the arts and sciences, and in the three professional schools of business administration, engineering, and medicine. Originally an all-male school, in 1972 Dartmouth began admitting women, who now constitute approximately 45% of the undergraduate students. The students are bright and academically talented; for example, median SAT scores for the incoming first year class were 630 Verbal, 700 Math. Approximately 20% of the students currently major in science, a percentage which has slipped noticeably during the last 10-15 years, in parallel with national trends. Currently, 40-45% of the women in the first year undergraduate class arrive at Dartmouth interested in studying science; by the time of graduation, 15-18% of women have majored in the sciences, representing a 60-66% attrition, compared to a 44% rate of attrition for men.

The objectives of the Women In Science Project are: 1) increases in the numbers of women majoring in science and engineering, 2) increases in the numbers of women enrolled in science and engineering courses, and 3) increases in the numbers of women entering scientific and technical careers. The Women In Science Project is primarily focused on first year women undergraduates for two reasons: 1) course selection decisions made during the freshman year are crucial in determining whether or not a student will major in science and 2) since first year students have the highest level of interest in the sciences, successful strategies for retention will yield the greatest numbers of new scientists. By 1994, when this year’s freshman class graduates, we hope to have increased the numbers of women majoring in science by at least 5%.

At the core of the Women In Science Project are research internships, through which first year women are invited to spend ten hours each week working with a faculty member in the sciences on his or her research. The internships are offered in each of Dartmouth’s science departments: biology, biochemistry, chemistry, computer science, earth sciences, engineering sciences, mathematics, and physics and astronomy. They represent an unusual opportunity for freshmen, offering a firsthand experience with scientific inquiry as a complement to introductory science classes. The internships also, in offering one-on-one work with a faculty member, link students with potential role models and mentors, both faculty and graduate students. In getting early “hands-on” experience in the laboratory, students gain skills and confidence which often boost their interest in continuing in science. A final feature of the internships is that students are paid to undertake the work; stipends ensure the full participation of economically disadvantaged students, so that a student may fulfill her financial aid obligation to work part-time with an internship rather than with a job in the dining hall. As one commented, “Unless funded, I would not have the time to continue this experiment to the extent it demands...”

Additional project components include panel discussions, a mentoring program pairing freshman women with senior women majoring in the sciences, career workshops, industrial site visits, and special speakers. In addition, we have begun to develop relationships with industry to offer women opportunities for direct linkage to summer science internship opportunities. A newsletter, distributed every two weeks, largely via electronic mail to all participants and numerous others around the campus, serves as the figurative “glue” for the project, reminding all of the project’s existence.
and goals, alerting readers to colloquia and other events of particular interest to prospective scientists, and offering profiles of women faculty members and research projects.

Finding resources to sustain this ambitious project continues to challenge us. Once it became clear that financial support would not be developed quickly, the scope of our efforts was somewhat narrowed in response to limited resources, and this academic year has served as a “pilot project,” with many strategies left for later implementation. We concentrated on developing the research internships, in part because the enthusiasm and support of the science faculty for this initiative was high. Faculty members have been generous in investing time and energy in the internships, in some cases supporting them financially through their own limited research funds. Federal work-study monies available for eligible students also allowed us to stretch limited resources. But still student interest in research internship opportunities exceeds funds available to finance them. Temporary allocations from internal budgets have been generous, considering that resources for new initiatives are quite limited in this era of tight financial constraints for higher education nationwide. External fundraising appears to be a realistic opportunity for some project support, but requires significant effort and a longer horizon for development. The project received a three-year grant from IBM this spring, as well as a small allocation from a Sloan Foundation block grant awarded to the national Association of Women in Science grant for mentoring efforts; otherwise, all financial support of the project was internal, mostly from temporary allocations of funds and positions.

We began to plan the project during the winter and spring of 1990. In response to a memo sent to faculty to ascertain interest in supervising students in research internships, fully half of the science faculty offered to do so. Participation in the project was offered to all incoming first year undergraduate women. Upperclass women interested in science, women graduate students in science, and interested faculty and staff were also invited to receive the newsletter. In the fall of 1990, in response to presentations during orientation week, 112 first year women signed up as participants in the Women In Science Project and several others asked to participate during the course of the year, the total representing about one-quarter of the eligible population. Of these, 60 applied for 22 research internships available fall term. Some students who were not selected for internships persisted in their interests: a few volunteered in faculty research labs or sought out similar opportunities on their own; for others, not receiving an internship assignment represented a discouraging influence in the possibility of their continuing scientific study. An internal grant of funds and the AWIS grant mentioned above, in combination with faculty research funds and work-study monies, allowed us to fund 30 internships winter term, and 28 spring term. Mid-year, an agreement was developed with the Hanover-based national U.S. Army Cold Regions Research and Engineering Laboratory (CRREL) through which the lab would fund up to four interested research interns working under the supervision of their scientists; though we have not had students interested in these internships to date, we are optimistic that a good partnership will develop here over time.

The newsletter, produced every two weeks by a student intern, proved to be a good vehicle for communications. Speakers and visitors for the Women In Science Project this year included Dartmouth biochemist Lucile Smith, former Vermont Governor Madeleine Kunin, Harvard AIDS researcher Phyllis Kanki, NASA astronaut and physician Mae Jemison, and Caltech chemist Jacqueline Barton, each of whom
offered a public lecture and a separate opportunity to meet with interested project participants for further discussion and conversation. Other special programs during this pilot year of the project included panel discussions with upperclass women science majors, with four women members of Dartmouth’s science faculty, and with women employed in industry as scientists and engineers, two telecasts of national science programs, a tour of the CRREL facilities, and a career workshop on summer and leave term opportunities.

In creating the Women In Science Project, to avoid just adding another layer of activities to the numerous programs offered to students around the campus and to use limited resources cost-effectively, we worked toward collaborating with those directing student programs and activities. Enlisting the support and interest of numerous others around the campus was important to the project’s success and visibility, although actual programs directly supporting the project’s objectives were limited to one or two cases, the most significant being the link between the Women In Science Project and an established senior-freshman mentoring program for women. As a result, we still found it necessary to organize some programs and activities. It is strategically important in creating this kind of retention project to involve both faculty and student services staff, each brings a different perspective to the problem and the intersection of their suggested solutions may offer the most effective strategy, as well as a better understanding of student needs and experiences. Widespread knowledge of the Women In Science Project across campus was also important to its success; not only could individual staff and faculty members support our efforts in small ways, but the project’s existence in itself offers encouragement to students. In responding to an evaluation for the project at year’s end, several students who had not attended programs or participated in project internships still commented that the obvious presence of institutional support for women in science, represented by the project, was a factor in encouraging their interest and pursuit of science.

An increase in the number of women majoring in the sciences cannot be measured until this year’s freshman class graduates, although a reasonable interim measure will be available at the end of the next academic year when students have completed their sophomore year at which time they declare majors. Although it is too early to know if our strategies have been successful, reactions to the Women In Science Project have been enthusiastic. A large number of students were interested in participating, and their response to the programs offered, particularly the research internships, has been quite favorable. A questionnaire was distributed in late May to evaluate participants’ reaction to the project, and the response so far indicates that our efforts to encourage women to pursue their interests in science have been helpful. Though many students report their interest in science has diminished during the course of their first year at Dartmouth, as we would expect from previous experience, there were also numerous reports of the extent to which research internship experiences and other aspects of the Women In Science Project sustained or enhanced student interest in the sciences.

The estimated annual budget required to implement the project fully for first year women is approximately $200,000, more than half of which is needed to fund research internships, based on offering 40 each academic term. Expanding the base of external support available will be crucial to the future of the project.
Conclusion

The Women In Science Project represents an important initiative in higher education. It addresses a significant problem -- the underrepresentation of women in science -- and seeks to improve opportunities and access for these students. The Project's research internships offer first year women undergraduates an unusual opportunity, not readily available on most college campuses. The sequential nature of science courses and related prerequisites makes the freshman year a crucial decision point in whether or not a student elects a science major. Yet often first year students have little real experience of the process or methods of scientific inquiry, or of the excitement and rewarding interest it can offer. Through internships and other activities, this project seeks to offer students greater experience and information to make decisions.

So far received enthusiastically by students and faculty, the Women In Science Project's design reflects research findings concerning women's experiences in science. The project has established and is beginning to test a comprehensive model for encouraging more students of all kinds to pursue science.

4 Sheila Tobias, "They're Not Dumb, They're Different: Stalking the Second Tier." Research Corporation, Tucson, 1990.