Supporting Females in a Male Field: Philanthropy for Women's Engineering Education

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Supporting Females in a Male Field: Philanthropy for Women's Engineering Education

Abstract
Through most of the twentieth century in the United States, science was commonly assumed to belong to men's intellectual sphere and workplace. Narrow assumptions about proper gender roles discouraged many women from pursuing scientific studies, while many science programs discouraged women's applications or flatly denied women access. For those women who chose to persist, moving ahead in the scientific profession required fighting persistent employment discrimination and institutional obstacles within academia, government, and business. In the face of such structural barriers, the force of "creative philanthropy" helped generate a few meaningful opportunities, as Margaret Rossiter has detailed. Endowments specifically established for hiring female scholars brought women into new slots on the faculties of both Harvard and the University of Michigan during the post-World War II period, Rossiter explains. Radcliffe dean Bernice Brown Cronkhite took one step toward remedying universities' usually miserable treatment of female graduate students by raising funds to open a dormitory and living center for those women in Cambridge in 1957. Meanwhile, ever since the late 1800s, the American Association of University Women had awarded fellowships to female students. By the late 1960s, generous donations from members enabled the AAUW to increase both the number and the size of its fellowships; in cases where departments proved reluctant to support female graduate students, AAUW assistance was especially valuable.

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Comments
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Just as the organizers of such efforts strove to help women scientists overcome some of the difficulties facing them in graduate school
The power of "female creative philanthropy" also played a role in shaping conditions facing women in American engineering. Even more than in science, American engineering has a gendered history, one which for decades prevented women in any significant numbers from finding a comfortable place in the predominantly male technical world. In the United States during the 1950s, women studying or working in engineering defied traditional gender norms and were popularly perceived as oddities at best and outcasts at worst. Overall, women made up less than 2 percent of students in college and university engineering programs during those years. Yet by century's end, women's presence in American engineering had become accepted, even encouraged (at least officially). In 1996, women made up roughly 18 percent of students earning bachelor's degrees in engineering. Such a substantial gain was no coincidence. This dramatic change in the gender dimensions of this field reflects in part a strategic use of philanthropy to counter barriers rooted in the institutional culture of higher education and in the social culture of engineering.

In the narrower sense of the word "philanthropy"—that is, in the realm of financial donations—women supported other women by endowing scholarships for female engineering students or by funding the construction of women's dormitories. But the true historical force of philanthropy becomes clear when the more expansive sense of the word is considered. Philanthropy as benevolence—doing good—was crucial to expanding opportunities for women in engineering. Women volunteered countless hours to assist other women and young girls in pursuing the dream of an engineering education. In individual efforts, female engineers mentored others, taught special classes, and offered informal advice on both career and personal questions. At a group level, female engineering students at dozens of colleges banded together to organize support networks and numerous activities. At an institutional level, the Society of Women Engineers (SWE) established many different support mechanisms that expanded over the years.

This tradition of help extended across generations. Well into her eighties, Lillian Gilbreth (whose family life was famously portrayed in Cheaper by the Dozen) traveled around the country to meet with female engineering undergraduates. In turn, these college students hosted outreach programs for girls in high school, junior high, and elementary school. The net effect contributed significantly toward making the
intellectual, social, and personal atmosphere for women in engineering far more welcoming during the 1950s, 1960s, 1970s, and 1980s. Philanthropy, of course, had its limitations; voluntary efforts could not satisfy all needs, could not always overcome ingrained institutional lethargy or individual resistance, and did not instantly turn the field of engineering into a female paradise. Much work still remains to be done to draw more women into engineering and enable them to advance in the profession. Across the United States today, many individuals and groups continue to develop outreach and support programs for women in engineering. This article offers the background history of such ongoing work, female creative philanthropy aimed at addressing the traditional gender limitations of engineering and at broadening women's opportunities in this avenue of education.

MIT, A PHILANTHROPY CASE STUDY: MONEY AND MUTUAL SUPPORT

For decades, Americans treated the professional study of technology as men's territory. Well into the twentieth century, preeminent engineering schools remained largely closed to women. Rensselaer Polytechnic Institute only opened its doors to female students as a World War II emergency measure. Other universities took even longer to acknowledge women: Caltech, Georgia Tech, and Princeton did not admit female undergraduates until the 1950s and 1960s, and then only after extensive agonizing and argument. In each case, shifting composition of the student body forced universities to rethink their physical, social, and academic environments. Faculty, administrators, and students faced the challenge of creating space for women in an intellectual world and a campus climate assumed to be for men.

The Massachusetts Institute of Technology had actually been coeducational since 1871. Its first female graduate, Ellen Swallow Richards, had created the Women's Laboratory, a special program that she hoped would keep MIT involved in training other women in chemistry. But school trustees resisted admitting “coeds” (as female students were called, and as I will therefore refer to them here) to regular courses, citing the lack of suitable accommodations. In 1882, alumnae raised $8,000 to build women's bathrooms, aiming to ensure that MIT could no longer excuse its neglect by citing inadequate facilities. The first women's lounge was “a tiny cubbyhole with one rocking chair and little else in the way of comfort”; the next contained “a sink, locker,
here for women in engineering 1960s, 1970s, and 1980s. Philanthropy aimed at addressing engineering and at broadening education.

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In each case, shifting universities to rethink their missions. Faculty, administrators, creating space for women in an assumed to be for men. 2

World War II brought massive upheavals to campus routine, and Compton seized the occasion to rethink policy. Contemplating the postwar place of women at MIT, he wrote, "For reasons, some logical and some traditional, technology has been predominantly of interest to the male of the species. [Nevertheless] the female continues to display both interest and effectiveness in technological pursuits, . . . slowly but definitely increasing." Compton noted that MIT had never helped coeds find housing in Cambridge, a "serious" problem that made parents nervous about letting their daughters attend. One mother, "afraid that her daughter will develop into a queer sort of person interested only in her work," had wanted supervised housing "as a good influence and balance wheel." Compton recommended that MIT rent or buy an old house to fix up as a women's dorm, an idea seconded by Florence Stiles, advisor to women students. Stiles noted regretfully that while coeds entered MIT with records at least equal
to their male counterparts, only one in twenty completed degrees. She hoped a centralized residence could create "esprit de corps" among female students and prevent so many from dropping out.6

In 1945, as "a small scale experiment," MIT opened a women's house at 120 Bay State Road in Boston. The location—a half-hour distant from campus by subway and trolley—proved inconvenient. More unfortunately, since the Bay State house held only fourteen first-year women, MIT capped female enrollment at that number (plus a few married and commuter students). Admissions officers discouraged many high school girls from applying and ultimately evaluated women more selectively than men. Typically, MIT rejected four qualified women each year due to lack of dorm space alone. Throughout the foreseeable future, officials admitted, coeds would "continue to be grossly outnumbered by men in classroom and lab."

This attitude summarized the postwar stance of the school: as long as MIT could fit in a few women without much trouble, it would, while generally ignoring the existence of this anomalous population. In 1947, the dean of students defined MIT as an institution intended "to prepare men for ... engineering, ... [and] educate ... men for responsible citizenship." As women's advisor, Stiles explained, the sense was that "women in general do not make acceptable engineers." One observer later wrote, "Before 1960, women entered MIT at their own risk. If they succeeded, fine; if they failed—well, no one had expected them to succeed." The few coeds enrolled hesitated to rock the boat. "I was very conscious of having to represent women in each class. If I did anything wrong, ... said anything stupid, it would be ammunition for all the men who didn't want us there in the first place," recalled engineering graduate Christina Jansen. "Discriminatory events were so common that it didn't occur to us to object." Besides, "other engineering schools weren't accepting women, ... so even though MIT was only accepting twenty a year ... I felt MIT was doing us an enormous favor to have us there at all."11

Skeptics doubted it would ever prove "possible to provide a small group of women ... with a sound environment for study in an institution primarily designed for men."12 The 1950s brought further makeshift housing arrangements. MIT tried putting coeds in Boston University dorms, but noise made studying impossible. Bexley Hall at MIT, which housed the few women students who survived their first year, had no dining hall or social areas to foster any sense of community. In addition, coed life offered few amenities: MIT's gym barred
twenty completed degrees. She created “esprit de corps” among her students, a location—a half-hour trolley—proved inconvenient. Bexley Hall held only fourteen first-year students at that number (plus a limited number of new women). MIT rejected four qualified applicants, admissions officers discouraged women from applying, and ultimately evaluated women on space alone. Throughout the 1950s, coeds would “continue to be women and granted swimming pool access only at rare, inconvenient hours. In terms of facilities, administrators conceded, “Women are the ‘forgotten men’ at MIT.”

The dean of students concluded that MIT faced a fundamental choice: either “eliminate women students . . . ; or, decide we really want women, plan an adequate set-up, and then deliberately go out and get more good girls.” Many argued for eliminating coeducation, noting that six of twenty-three new women had run into first-semester academic trouble. Margaret Alvort, women’s-house supervisor, wrote that her “doubt as to whether [coeds] belong . . . has grown into certainty that they do not.” If MIT wanted to serve the nation by turning out as many excellent scientists and engineers as possible, then “there is little in the records of the girls . . . to justify their continuance.”

MIT’s medical director agreed: “[W]hen there is such a shortage of engineers, one wonders if we are justified in taking positions away from male students for female.” Coeds brought “pleasure and ornamentation” to campus, but could rarely hold their own against “high-grade intellects.” Further, to try to do so would be self-detrimental: while MIT men displayed healthy competitiveness, aggression in women signified emotional “conflicts” and rejection of femininity. In short, he declared, “except for the rare individual woman, [MIT] is an unsuitable place.”

Significantly, MIT president James Killian believed some women could succeed and therefore deserved access. He wrote, “I do not see how the Institute, having admitted women for so long, can now change”—nor should it, considering that Cold War competition against the Soviets demanded that the U.S. develop all professional talent. Striving to “think more boldly . . . about recognizing [women’s] presence,” Killian broached the idea of setting up a women’s college inside MIT, similar to Oxford’s system or the Harvard-Radcliffe arrangement. Women would attend classes with men but have a separate dormitory with self-contained eating and recreation facilities. Plans for a women’s college could attract support from private donors, Killian predicted, and for the first time “really justify . . . admitting women students.”

In 1960, Katharine Dexter McCormick pledged $1.5 million to build MIT’s first on-campus women’s dorm. At the turn of the century, McCormick had attended MIT as a “special student” for three years to prepare for qualifying exams, then earned a degree in biology after four additional years. In her will, she wrote, “Since my graduation
in 1904, I have wished to express my gratitude to the Institute for its advanced policy of scientific education for women . . . , which has been of inestimable value to me throughout my life.” McCormick knew that in her day, MIT had enrolled forty-four women, a figure that had risen only slightly five decades later. When announcing McCormick’s donation, MIT president Julius Stratton observed that the gift “affords us an unprecedented opportunity to improve [women students’] residential and social environment, advance the[ir] development . . . in the scientific professions . . . . Indeed, woman’s potential for achievement in these fields represents one of the great latent resources of the country.”

The new building was conveniently located just one block away from MIT’s main instructional complex. The architect took pains to plan feminine amenities, such as bathroom space for hand laundry and places downstairs for residents to receive male visitors. Dedication of McCormick Hall in 1963 attracted national publicity. “Hardly anyone imagines girls attending mighty MIT,” Time reported. “Yet last week Tech . . . dedicated its first women’s dormitory to go with its first women’s dean, an attractive blonde lured from nearby Radcliffe.” Seventeen touted MIT’s “luxurious new women’s dorm overlooking the Charles River.”

MIT used McCormick Hall’s opening to draw attention to its female students. Noting that “opportunities for women in science [and] engineering . . . are clearly increasing,” the 1963 catalog mentioned up front that MIT was coed. In 1964, women’s applications jumped fifty percent. McCormick wrote to Stratton that she was “happy to hear of the increase . . . . I have been so grateful for all I received from the Institute that I realize how much Tech will mean to them, and I am happy to think that perhaps the women’s dormitory has been a factor in this increase.” Backers of coeducation hailed McCormick Hall as a “vote of confidence,” “testimony . . . that women are to remain a permanent part of MIT.” Now that the university had finally created physical place on campus for female students, women’s dean Jacquelyn Mattfeld called on MIT to integrate coeds intellectually and socially. A “conservative . . . Wall Street attitude toward women still runs through MIT’s veins,” she declared; many male professors and students regarded female undergrads as “incompetent, unnatural, and intruders.”

McCormick initially provided beds for 120 coeds, more than ever before. Yet with increased applications, deans forecast that MIT would
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attitude to the Institute for its women . . . , which has been my life." McCormick knew our women, a figure that had been announcing McCormick's observed that the gift "affords improve [women students'] resi­ development . . . in the latent resources of the coun­
located just one block away. The architect took pains to a space for hand laundry and male visitors. Dedication of national publicity. "Hardly anyone 'time' reported. "Yet last week dormitory to go with its first from nearby Radcliffe."19 women's dorm overlooking the campus for hand laundry and male visitors. Dedication of national publicity. "Hardly anyone 'time' reported. "Yet last week dormitory to go with its first from nearby Radcliffe."19 women's dorm overlooking the

To raise morale, Mattfeld looked to McCormick's funding for the second stage of construction, which could double women's housing. Admissions staff confirmed they could find another fifty good female candidates each year, doubling the number per class.25 There was no reason for "fear that MIT will suddenly be over-run by the Fair Sex," Mattfeld reassured doubters; raising female enrollment to four hundred would only lift women from 3 to 8 percent of the total student body. Moreover, she argued, improving "educational opportunities for one portion of the population cannot help but be beneficial to the whole." Mattfeld wanted MIT to become a model academic commu­nity recognizing women's scientific and engineering potential. She emphasized that McCormick's second tower should include not just more beds, but also recreational facilities such as swimming pools and music studios. Coeds would perform better, Mattfeld insisted, once they felt at home.26

Even as Mattfeld pored over blueprints for expanded undergrad­uate housing, McCormick instead suggested that the second tower house female graduate students, whose greater professional commit­ment seemed to make them better "investments." MIT worked to persuade her that female undergraduate enrollment had not yet reached optimum size. Women would only continue on to graduate study in science if they had a supportive undergraduate climate, officials stressed. Moreover, graduate women, especially married ones, did not want dormitory life.

Administrators convinced McCormick that undergraduate women's housing remained essential, and indeed, her donation of dormitory funds proved vital. In days when many factors discouraged girls from pursuing professional interests, MIT presented positive pictures of female science and engineering majors. Descriptions of McCormick life suggested that coeds were not unwomanly freaks obsessed with mathematics; one article observed that the "condition of floor kitch-
nnettes and... sewing machine[s] suggests that [coeds] cook and sew as well as run computers." Administrators made dorm activity part of strategies encouraging women to succeed in male-dominated fields. MIT brought female visiting professors, such as neurobiologist Rita Levi-Montalcini, to spend weeks in residence at McCormick, talking to coeds about their research and their experiences as female professionals.27

Even as they met with renowned women scholars, this new McCormick generation of MIT coeds gained national visibility themselves as they began to confront frustrations more openly and band together to consider remedies. After receiving degrees, numerous MIT graduates encountered employment discrimination: companies questioned how long a woman engineer would remain on the job. To address such issues, the newly invigorated Association of Women Students (AWS) helped organize a "Symposium on American Women in Science and Engineering" at MIT in 1964. Planners hoped to attract widespread media coverage, teaching industry professionals and the public that women could be good scientists and engineers. Organizers also wanted to encourage young women to consider those careers, aiming to describe "the mythical and actual difficulties they may... encounter, to convey that these are not insurmountable, and to assure that the satisfaction and rewards are high." The symposium attracted college faculty and administrators, high school students and guidance counselors, and more than 250 delegates from Smith, Radcliffe, Wellesley, the University of California, Georgia Tech, Northwestern, Purdue, and other institutions. The novel coming together of such a large group served an important purpose in itself; one mechanical engineering major from Michigan State University said she found it "re-assuring to see so many other women in the same situation." Speakers such as Radcliffe president Mary Bunting called on employers to provide day care and flexible schedules to help women balance motherhood and work. University of Chicago professor Alice Rossi urged society to cultivate girls' independence, curiosity, and reasoning. Psychologist Erik Erikson encouraged women to stop depending on men for approval, to envision a future beyond being a husband's domestic helpmate.28

In the early 1970s, MIT instituted an ad hoc committee "to review the environment... for women students." Co-chaired by engineering professor Mildred Dresselhaus and engineering major Paula Stone, the committee reflected fundamental feminist principles. It declared, "A
ests that [coeds] cook and sew or made dorm activity part of their male-dominated fields, such as neurobiologist Rita Dresselhaus, talking about her experiences as female professors, this new movement gained national visibility through more openly and band "coeds faced both open hostility and more subtle prejudice, the committee wrote.

If many people (professors, staff, male students) ... persist in feeling that women jeopardize the quality of MIT's education, that women do not belong in traditionally male engineering and management fields, that women cannot be expected to make serious commitments to scientific pursuits, that women lack academic motivation, that women can only serve as distractions in a classroom, ... then MIT will never ... be a coed institution with equal opportunities for all.

The committee's report represented a self-directed rallying cry, telling MIT women that gender discrimination would change only when female students, faculty, and staff organized to demand improvement.

The early 1970s brought a burst of activism, as MIT women drew strength from the national feminist movement to assert their presence physically, intellectually, socially, and politically. Listing all the awards coeds received, advocates documented that women could lead and succeed in difficult studies. AWS produced pamphlets encouraging high school girls to apply, emphasizing that "there is an enormous pride in being a 'tech coed,' ... great satisfaction in having done something difficult and worthwhile." To help MIT women establish a positive sense of identity within a male-dominated atmosphere, campus women's groups initiated monthly colloquia addressing wide-ranging feminist subjects such as the nature of androgyny, sexism in popular culture, and the strengths and difficulties of two-career marriages. Dresselhaus and Professor Emily Wick created a new organization, the Women's Forum, which brought together undergraduates, graduate students, faculty, staff, and wives of all of these to develop "consciousness-raising skits," express concerns about women's health, athletic opportunities, day care, and career planning, and otherwise raise gender awareness.

MIT women continued worrying, especially about the question of numbers. In the early 1970s the admissions office revised photographs and text in the Institute's catalog to highlight coeds and sent special recruiting material to all female national merit and national achievement scholarship semifinalists. AWS feared that such measures would not suffice to overcome social forces pushing girls away from science and engineering. It would take "high-powered" efforts to increase fe-
male enrollment, “to de-mythify incorrect assumptions about women at MIT.”32 Women’s advocates worried that MIT’s “educational counselors,” members of the male alumni network who spoke to potential applicants, would not encourage high school girls to enter nontraditional fields or address their concerns about coming to MIT. AWS urged coeds to contact hometown seniors over Thanksgiving and Christmas vacation. “The women in particular may just need an encouraging word from you before taking the plunge.”33 AWS members also volunteered to sit in the admissions office during the peak interview period, ready to chat with interested young women.

Mattfeld and her successor, Professor Wick, served as administrative advocates for female students throughout the sixties. Wick wrote, “As the number of women students increases (and it cannot fail to do so if admissions criteria are the same for all applicants) it is essential that MIT be sensitive to their needs . . . , prepared to assist women students as they make their way through this very male institution.”34 Precisely because of their small numbers, “women are treated differently from men in MIT classes.”35 Mattfeld and Wick stepped in to mediate when coeds encountered trouble dealing with advisors, professors, or teaching assistants. Similarly, most of MIT’s few women faculty considered it their responsibility, as successful professionals, to lobby on behalf of other women on campus. Professor Sheila Widnall complained, “Engineers may have a view of engineering which is twenty years out-of-date, and they communicate that to other people. Engineers have an image of engineering that is very masculine . . . [and] takes a long time to change.” In 1976, she described women’s activism as a “very exciting” force that could open wonderful opportunities for new generations of girls. “There’s obviously a direct connection between militant feminism in the junior highs and the ultimate enrollment of women in engineering . . . Everybody, mothers in particular . . . are much more aware of the importance of encouraging their daughters to take life seriously.”36

Widnall and other female professors worked behind the scenes to convince deans to back women’s education. In 1975, MIT’s Center for Advanced Engineering Study produced a film entitled Engineering: Women’s Work. It was one of the first movies aimed at combating the field’s macho image. The film followed “real-life” female students and professionals through their daily routines to show high school students, parents, guidance counselors, and the public that affirmative action had opened up interesting and lucrative opportunities. The
ect assumptions about women that MIT's "educational counselor who spoke to potential school girls to enter nontraditional about coming to MIT. AWS seniors over Thanksgiving and articulated may just need an ent; the plunge." AW members office during the peak interested young women. Wick, served as administration throughout the sixties. Wick wrote, increases (and it cannot fail to do for all applicants) it is essential . . . prepared to assist women through this very male institution."34 Others, "women are treated differently and Wick stepped in to people dealing with advisors, primarily, most of MIT's few women , as successful professionals, to campus. Professor Sheila Widnall view of engineering which is communicate that to other people. teaching that is very masculine . . . 1976, she described women's could open wonderful opportu. There's obviously a direct connection the junior highs and the ultimate . . . Everybody, mothers in the importance of encouraging others worked behind the scenes to continuation. In 1975, MIT's Center produced a film entitled Engineering: movies aimed at combating the "real-life" female students and pictures to show high school students the public that affirmative lucrative opportunities. The film's release drew national attention, and administrators considered it a major contribution to promoting the cause of women in engineering.37

Earlier, in 1973, MIT had convened another workshop on women in science and engineering, featuring panels on women's professional status and workshops on career planning. Organizers hoped to convert parents, schools, and the national media into agents of change, helping to break down outdated sex-role stereotypes that steered women into low-paid, shrinking occupations such as teaching. "Enlarging opportunities for women must include not only opening all doors, but also helping women to have the motivation and the courage as well as the educational preparation for walking through them." Embracing feminist language, MIT president Jerome Wiesner spoke about a need "to encourage women's participation in every aspect of our technological society. This is another front in the almost universal battle for equality of opportunity." Workshop leaders called for revising lower-school curricula in order to attract girls toward nontraditional fields, sensitize parents to girls' ambitions, and teach boys to "understand the importance of eliminating sex barriers."38

Women's advocates considered 1973 a year for celebration. In June, the Association of MIT Alumnae (AMITA) commemorated the one hundredth anniversary of MIT's women graduates. AMITA hailed the fact that female enrollment had tripled in just ten years, reaching 816 (roughly 13 percent of the total student body). In the freshmen class, the number of enrolled women went from 48 out of 958 students in 1965 (5 percent) to 211 out of 1036 in 1974 (20 percent). The evidence seemed to validate supporters' belief that women's academic performance would improve with more favorable living conditions now available in McCormick Hall. The proportion of coeds completing degrees on time rose from 33 to 64 percent (equivalent to male students' performance) during the early 1970s; women graduated with higher GPAs than men, and a larger proportion moved on to graduate studies.39

A number of activities sponsored by faculty and alumnae also aimed to continue improving the lot of women engineers. By 1974, female faculty and staff were getting together for monthly lunches, hoping to multiply their impact on Institute policy. Pursuing an activist stance inside the engineering school, Professors Dresselhaus and Widnall inaugurated a freshman seminar entitled "What Is Engineering?" Though not restricted to coeds, the course was geared primarily
toward them, starting from an assumption that women often avoided technical subjects simply because they sounded unfamiliar. Researchers in various engineering fields visited the class to explain their work. In order to make women comfortable with manual skills, the syllabus also included lab projects in electronics, welding, drafting, and building Heath Kits (a popular brand of do-it-yourself electronics sets). Dresselhaus further helped organize meetings entitled "Let's Talk about Your Career"; at these gatherings, female students consulted faculty, staff, and guest lecturers for advice about graduate school, employment, and the eternal question of combining marriage with work. Arguing that male students' familiarity with the business world gave them a competitive advantage, AMITA started an annual seminar, "Getting the Job You Want in Industry: A Woman's Guerrilla Guide to the Pin-Striped World." By advising coeds on resume writing and interview techniques, alumnae hoped to level the playing field.

Advocates drew heavily on their teamed strength as potential difficulties loomed. By 1976, budget cuts had prompted the admissions office to limit targeted mailings and start skimping on other "extras" needed to draw female applications. While MIT once led efforts to recruit high school girls talented in math and science, other colleges, such as Cornell, Caltech, and Purdue, had since launched campaigns competing for that small pool. AWS undergraduates, faculty, and staff redoubled efforts to welcome potential coeds. During a spring vacation telethon in 1978, volunteers called 172 high school women who had been accepted; two-thirds of those contacted ultimately chose to attend the Institute. The sense that this personal touch made a difference in raising the "yield" convinced a few undergraduates to undertake a more intensive project. Noticing that women made up just seven out of forty-one students accepted from their home state of Michigan, these coeds sent out hundreds of newsletters seeking to combat the stubborn "perception among most ... girls that science and technology are not appropriate or desirable fields of study or work for them." At symposia in Southfield and Kalamazoo, Michigan, MIT professors and recent graduates encouraged high school women to keep their educational and career prospects open by staying in math and science classes.40

By the late 1970s, female students made up 17 percent of MIT undergraduates, 16 percent of the graduate body, and 12 percent of engineering majors. The sheer increase in population mattered; as women became more of a presence on campus, activists gained a
that women often avoided manual skills, the syllabus also included welding, drafting, and building electronics sets. Dressings entitled “Let’s Talk about Male Students Consulted Faculty, about graduate school, employing marriage with work. Although the business world gave them an annual seminar, “Getting Woman’s Guerrilla Guide to the playing field.”.

named strength as potential dis-advantages had prompted the admissions process to include other “extras” of MIT once led efforts to expand engineering and science, other colleges, had since launched campaigns. Such efforts included undergraduates, faculty, and staff. During a spring vacation of 12 high school women who had contacted ultimately chose to attend MIT. The personal touch made a difference. Few undergraduates to understand that women made up just seven percent in their home state of Michigan, and school women to keep their options open by staying in math and science.

made up 17 percent of MIT graduate body, and 12 percent of those in population mattered; as on campus, activists gained a critical mass for organization. Female graduate students formed their own society, as did women in architecture, in chemistry, and at Lincoln Laboratory—a federally funded research center which was part of MIT. Such groups kept women's issues on the front burner, providing a sense of visibility, an identity, and a cause for many individuals. These societies proved especially valuable to female faculty and graduate students based in departments with few other women.

Advocates had successfully established the principle that women’s success in the classroom depended on providing both a literal and a psychological home for them in the midst of a male-oriented, often hostile landscape. For decades, MIT had used lack of housing as an excuse to ignore coeds. Only with money from a powerful alumna did the university finally decide that “girls” really “belonged.” Only with the construction of McCormick Hall did MIT offer women viable, visible space in the campus community.

THE SOCIETY OF WOMEN ENGINEERS: THE POWER OF PHILANTHROPIC SUPPORT

In their battle to secure expansion and improvement of women’s position at MIT, advocates volunteered their money, time, and effort. Both their philosophical dedication and the particular strategies they embraced were echoed at dozens of schools across the nation during the 1960s, 1970s, and 1980s. Such commitments owed much to the Society of Women Engineers, which initiated, coordinated, and supported literally hundreds of undertakings—both small and large, local and national—to help women pursue an engineering education and career.

In 1946, about twenty female engineering students at Iowa State University had organized a local group called the “Society of Women Engineers” to assist “in orienting new women students in the division.” That same year, female students at Syracuse and Cornell vented their frustration at being either excluded from several major engineering honor societies or else restricted to a “woman’s badge” instead of full membership. Pi Omicron, the new honorary society they created, soon had chapters at schools around the country. Members held orientations for new female engineering majors and hosted speakers such as Lillian Gilbreth. Its mission was “to encourage and reward scholarship and accomplishment... among the women students of engineering...
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[and] to promote the advancement and spread of education in . . . engineering among women." 41

In 1950, female engineers in New York, Boston, Philadelphia, and Washington, D.C., began meeting with each other; in 1952 they officially incorporated as the Society of Women Engineers (SWE), a professional, nonprofit educational service organization. According to an early statement, SWE was organized around the following objectives:

To inform the public of the availability of qualified women for engineering positions; to foster a favorable attitude in industry toward women engineers; and to contribute to their professional advancement. To encourage young women with suitable aptitudes and interest to enter the engineering profession, and to guide them in their educational programs.

In an effort to reach these young women (along with their parents, teachers, and counselors), one of SWE's first acts was to set up a Professional Guidance and Education Committee, which would supply information on college programs and engineering in general. 42

Volunteer efforts at disseminating information reflected one of SWE's primary beliefs: that girls often shied away from entering technical studies simply because they did not realize that women could and did pursue engineering, or because they lacked a basic understanding of engineering itself. Irene Carswell Peden, associate professor of electrical engineering at the University of Washington in the 1960s (its sole female engineering faculty member), wrote,

It is important to think of women engineers as real people doing real jobs which the student could do, too . . . A girl is not likely to choose a career field disapproved by her parents, teachers, classmates, and friends. All of these people . . . seem to be responding in part to an erroneous but popular image of the woman engineer as a cold, . . . aggressive female who trudges through life in her flat-heeled shoes without a man in sight (away from the job) . . . Many women engineers are very attractive; most represent a perfectly normal cross section of femininity. The only way that this image can be brought into line with reality, of course, is by way of personal contact. Few women engineers would refuse an opportunity to talk with interested girls and their parents and teachers. Society of Women Engineers . . . members are their own best public relations experts. 43

In 1954 and 1955, members of the Cleveland section of SWE appeared on local television programs to personally illustrate women's
d spread of education in ... York, Boston, Philadelphia, and each other; in 1952 they off- 
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- presence in the engineering profession. At a time when many Americans perceived female engineers as odd, manlike creatures, SWE members took pains to offer a presentable feminine image, emphasizing how many of them were married and had children. In 1958, the Boston SWE put out a pamphlet “for young women who might like to enter the field of engineering, and for teachers who are helping them to decide.” It contained biographical sketches of a few “typical” women engineers and gave readers information about qualifications for studying engineering and about potential career directions. SWE’s authors concluded, “If this pamphlet shall have inspired one young woman to consider an engineering career ... and one parent to ‘en- 
courage’ the daughter’s desire to enter the technical field, this pamphlet will then have been a worthwhile venture.”

Advocates believed that women engineers could gain greater accept ance in society simply by making themselves more visible, and thus SWE soon expanded outreach efforts. In the mid-1950s, college cam- 
puses began holding “Junior Engineer and Scientist Summer Institute” (JESSI) programs, thirteen-day courses to let high school students explore pure and applied science and also receive educational and career guidance. Each year, SWE members volunteered to assist with JESSI programs and to discuss women’s job opportunities in engi- 
eering. For example, at Colorado State University’s JESSI program in 1961, fifty-three girls listened to a five-woman panel discuss why they chose an engineering career, supply information on engineering colleges, and answer audience questions. On other occasions, women engineers led JESSI students on visits to industry and gave the girls (and boys) tours of their laboratories.

In the heady rush of creating a new organization with a crusading vision, SWE’s leaders dedicated enormous effort to the cause. They 
poured personal attention into reaching potential converts; members of SWE’s professional guidance and education committee wrote to 
dozens of high school girls, sending pamphlets and replying to ques-
tions. In 1954, four SWE members had lunch with one William and Mary first-year woman looking at engineering as a way of using her 
talent for math. Elsie Eaves wrote, “Roslyn Gittin, Althea Thornton and myself ... and Betty Mills ... gave her a pretty well rounded pic-
ture of civil, chemical and mechanical engineering and suggestions of 
how she could check with Columbia for planning her liberal arts work 
so that she could transfer to engineering if she wishes.”

By 1957, female engineering students at Drexel, Purdue, the Uni-
University of Colorado, CCNY, the University of Missouri, and several schools in Boston had founded student sections of SWE, and the parent organization enthusiastically welcomed its new junior counterparts. Many established SWE women vividly recalled their sense of initial isolation; as Carnegie Mellon associate engineering dean Helen O'Bannon later wrote, "being one of a small group following a path that appears to violate society's norms is lonely." SWE members spoke passionately about the anxieties and pressure facing a coed who found herself the sole woman in class. Many wrestled with a lack of self-confidence and a low self-image, factors worsened by teasing or hostility. Coeds needed a chance "to see by example that women can 'make it' in engineering," wrote Mildred Dresselhaus in 1975; they needed to receive advice and reassurance from older mentors. "Visibility of successful role models often provides the necessary encouragement to 'keep going when the going gets rough' or when she begins to ask, 'Is it worth it?' It is important for women students to see in some tangible way that there are career opportunities ahead of them, and to find out what it is like to be a professional woman engineer."47

Older professionals especially sympathized with young women at schools such as Georgia Tech, where many male classmates, faculty, and alumni bluntly expressed their disapproval of the fact that the institution had chosen to admit women at all. In 1958, the Atlanta section of SWE sent members to participate in Georgia Tech's start-of-the-year camp for first-year women.

Usually these coeds are completely unaware of future tasks in industry, and we feel that the revealing of our experiences and the impressing on them that they have a great responsibility as women engineers is a basic necessity. They are also encouraged to consult with members of SWE should they encounter any difficulties, even tutoring. One must realize that there are this year approximately 1300 freshmen at Georgia Tech and only 19 freshman coeds. There will be numerous problems and SWE Atlanta Section is proud to play an integral part in the quite difficult assimilation of female engineering students in an almost all male school."48

Through the 1960s, the number of SWE student chapters multiplied, reaching colleges and universities across the country. Established members offered support; for instance, the Los Angeles section of SWE provided speakers and counselors to student sections at USC, UCLA, Loyola Marymount, Harvey Mudd, Cal State Long Beach, Pomona, Fullerton, and Cal Poly San Luis Obispo. Overall, campus
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SWE groups offered vital intellectual, social, and psychological support for female engineering majors. Advocates stressed the value of "critical mass," having enough coeds for mutual encouragement and a commitment to "stick together." Karen Lafferty Instedt, a student at Ohio State University in 1968–1971, later wrote that SWE gave her "an opportunity to meet the other female engineers who, like me, were isolated in their respective fields and classrooms. The SWE section functioned as a refuge of sorts—where one could find an understanding ear from a peer or a kindhearted, encouraging professor or dean." By the end of the 1970s, student sections had been chartered in over 170 colleges, universities, and technical institutes. SWE held an annual national student conference featuring technical sessions and exhibits, professional workshops, industrial tours, and even sessions on career planning, power dynamics, management, personal assertiveness training, and how to "dress for success."

By the late 1970s, SWE's overall membership totaled over ten thousand women and men. As SWE grew, its leaders not only were able to draw on its own expanding membership resources, but also mobilized the political clout necessary for drumming up outside support. In the most obvious manifestation of this kind of philanthropy, SWE members donated and collected money to help young women finance their higher education. Starting in 1958, SWE had instituted the Lillian Moller Gilbreth scholarship for a woman in her junior or senior year of engineering school. Local chapters in the Southwest, in Kentucky, and elsewhere soon created their own scholarship funds. The Pittsburgh section offered awards to women engineering students who had finished freshman year in a Pennsylvania university or were Pennsylvania residents. By the end of the 1970s, SWE administered nineteen annual scholarship competitions worth more than $27,000 in all. The RCA Company supported SWE scholarships for third- and fourth-year women enrolled in electrical engineering, while the Westinghouse Educational Foundation funded Bertha Lamme-Westinghouse Scholarships (named in honor of that company's pioneering woman engineer) for first-year women. SWE activities at the college, regional, and national levels exploded during the 1970s, driven by members' enthusiasm and dedication, by the feminist movement, by government equal opportunity laws, and by university public relations needs. One of the most energetic programs was at Purdue University's engineering school, which had created a special staff position in 1968 to increase its female enrollment.
and promote retention. That intensive campaign paid off: Purdue's number of women engineering students rose from 46 in 1968 to 280 in 1974, and to more than one thousand in 1979, when the university boasted the nation's largest female engineering enrollment. The campus had one of the country's most active student SWE chapters. Among other activities, engineering coeds published their own newsletter, ran a "big sister" program pairing entering women with upper-class mentors, offered help in locating summer jobs, and produced an annual members' "resume book" for sale to potential employers. Each weekday, SWE "hostesses" volunteered to talk to prospective engineering students, take them to lunch, or offer a tour of residence halls.51

The 1970s witnessed the organization of dozens of conferences, open houses, and other public events in many states to celebrate and assist women pursuing engineering. Some meetings were organized by and for women already out in the work world, to give each other encouragement and suggestions for promotion. For example, a 1974 "Women in Engineering" conference jointly sponsored by SWE, the Engineering Foundation, and the Engineers' Council for Professional Development focused on advising women on how to update their skills (especially after temporary child-rearing leave) and advance into other areas, including management. Other conferences were designed for women still in college. These meetings sought to bring collegiate women together with each other and with older mentors who might help undergraduates succeed in their studies and prepare to enter the professional world. For instance, the University of Washington (with 230 women engineering students in 1975, and 445 in 1977) hosted an annual conference where those coeds met with working professionals such as Bonnie Dunbar, a Rockwell ceramics engineer. The SWE section at the University of North Dakota sponsored a 1979 conference entitled "Transitions: College to Careers," which brought in corporate representatives (many of them alumni) to talk about how to project a professional image, how to have a successful interview, how to handle postcollege finances, how to set career goals, and how to balance work and marriage. Speakers offered practical advice; for example, they suggested that women make an effort to communicate with their bosses, making a point to describe their career goals and suggest a schedule for accomplishing them.52

Other conferences were organized by women engineering students themselves as a way of encouraging the potential interest of younger
A campaign paid off: Purdue's engineering enrollment rose from 46 in 1968 to 280 in 1979, when the university sponsored student SWE chapters. Active student SWE chapters published their own newspapers entering women with upper-level engineering courses, and produced an annual to potential employers. Each chapter had to talk or offer a tour of residence halls.

Conferences in many states to celebrate and solve problems. In fact, most engineering students are a lot like you.

At the Iowa conference, current and former students spoke about “student life: trials and tribulations, joys and expectations,” while industry representatives and educators discussed course options and career opportunities. Similar events occurred across the country, with the aims of familiarizing young women with engineering, talking up employment opportunities, showing the most exciting sides of technical work, and allowing girls to meet role models. In 1976, the New Jersey Institute of Technology hosted an all-day program for three hundred young women; organizers had received more than six hundred attendance requests, far beyond their capacity. Faculty member Marion Spector said, “Typically women just let things happen, they float along with the current, not making any effort to set career goals. What we are trying to do is to give them an introduction to personal direction and to introduce alternatives while they are young enough to make strong changes.”

A 1973 University of Illinois conference, “Women in Engineering: It’s Your Turn Now,” gave high school junior and senior girls a chance to participate in “rap sessions”—informal conversations.

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with college SWE members and older women engineers. A 1974 symposium sponsored by SWE sections at the Universities of Florida and South Florida featured a tour of the Kennedy Space Center, plus discussions of student financial aid, co-op programs, career problems and openings, and men’s reactions to women engineers. The promotional material declared,

As an engineering student you’ll gain something most women don’t get in college, a professional skill which can be used immediately upon graduation . . . . [with] the highest starting salary bracket of the major professional job categories for women holding a bachelor’s degree . . . . You owe it to yourself to look into the possibilities and opportunities offered by engineering. 55

Other SWE chapters went directly into the high schools as self-described “missionaries” seeking to spread the gospel of technical study. Starting in 1976, Berkeley’s SWE section sent teams of three or four students and engineers to visit local junior high classes; in 1980, members gave presentations to about one thousand students in ten Bay Area schools. Presenters described how they became interested in engineering and sought “to dispel myths about women in engineering . . . and give special encouragement to girls who are interested in math and science.” One mechanical engineering major prepared posters showing how an engineer might design a pair of skis, another team brought slides showing construction of a hydropower plant. An organizer commented,

We discovered that women engineering students can be excellent role-models for girls in grades 7–12. A practicing engineer or scientist may be inspiring, but her achievement may seem unattainable to students who have not even started college. Junior high students, in particular, are more willing to take advice from those closer to their own age. “I was happy to find out that there are women engineers!” said one enthusiastic student . . . . “It showed me another kind of work I might be interested in.” 56

Berkeley section noted that running this community outreach program benefited SWE members themselves: it gave them experience in public speaking, led to useful professional contacts, and provided favorable publicity. Berkeley members even compiled a handbook for other SWE chapters that contained advice on how to start a similar outreach program. Taking outreach even further in the 1980s, SWE’s San Francisco section hosted a program entitled “Tinker . . . Toys . . . Technol-
women engineers. A 1974 symposium attended by the Universities of Florida and Kennedy Space Center, plus disArmy programs, career problems and opportunities in engineering. The promotional campaign was designed to disprove something most women don’t know: can be used immediately after graduation. A 1974 study found that women holding a bachelor’s degree earned the same starting salary bracket of their male counterparts. The promotion worked: “It showed me another community outreach program that there are women engineers,” in which seventy-one teenage Girl Scouts spent two weeks learning computer programming, running physics experiments, touring Silicon Valley companies, and talking with women engineers and astronauts.57

Other SWE members hoped to influence even younger girls, those still in elementary school. In the 1970s, the Boston section sought to “infuse a seven- or eight-year-old” with enthusiasm and curiosity about how things worked. It wrote and published a coloring book entitled Terry’s Trip, the story of a girl visiting her aunt, a mechanical engineer who worked in a toy factory. The heroine, Terry, talked to industrial engineers supervising the production line, chemical engineers mixing polystyrene, electrical engineers with fancy calculators, and then announced, “Maybe some day I’ll be an engineer like Aunt Jennifer and her friends at the factory.”58 The North Carolina section of SWE prepared a 1983 booklet called Betsy and Robbie, which told of a girl who visited her cousin at a university engineering fair and became fascinated with Robbie, a computer-controlled robot designed by a female student.59 Such material emphasized that women were fully qualified for engineering, a discipline that required creativity and logic more than physical strength. Illustrations and photos documented the daily activities of women who worked in safety engineering for General Motors, as government environmental engineers, or as university professors. By making such role models visible and attractive, SWE strove to win young women’s interest and public confidence.

Some SWE experts admitted that in the end it was virtually impossible to find a direct causal correlation between advocacy efforts and changing patterns of women’s engineering education. Taken in isolation, a child’s coloring book, a conference for high school girls, or even a new dormitory seemed to do little to affect such momentous decisions as where to attend college, what major to choose, or which career to follow. Yet as a whole, the multidimensional actions undertaken after 1950 by the national Society of Women Engineers, local chapters, student sections, and individual women add up to a substantial force. It was Katherine McCormick’s funding that made it physically possible for MIT to expand female enrollment, paving the way for advocates who pushed for broader changes in campus intellectual and social culture. Donations by other women established scholarships and awards for female technical students, giving them vital financial assistance and recognition. Philanthropy in a broader
sense—contributions of time and service—played an equally crucial role. Pioneering female engineers poured immense effort into nurturing their successors, offering advice and encouragement. SWE set up a social and professional bridge between generations that was rich with meaning both for those giving and for those receiving support. College women benefited from the guidance of older members as they themselves volunteered as outreach ambassadors to younger girls. Such philanthropy helped transform educational trends: by 1980, the number of female engineering students had skyrocketed. Today, high school girls take for granted that they have a right to study engineering if their interests lie in that direction. Philanthropists of the postwar decades have achieved their vision, creating a space for women in the traditionally masculine world of engineering education.

NOTES

1. For a discussion of women's use of "creative" and "coercive philanthropy" to pressure institutions to accept women graduate students and appoint women faculty, see Margaret W. Rossiter, Women Scientists in America: Struggles and Strategies to 1940 (Baltimore, Md.: Johns Hopkins University Press, 1982), 39; and Mary Ann Droback's chapter in this volume. For information on the AAUW, see Marion Talbot and Lois Kimball Mathews Rosenberry, The History of the American Association of University Women, 1881-1931 (Boston: Houghton Mifflin, 1931).


5. Massachusetts Institute of Technology Handbook, 1941, MIT.

6. Report of the President, MIT, 1944; Florence Ward Stiles to Compton, 3 February 1945; memo from Stiles, 22 February 1945; all three in file 18, box 210, AC 4, MITA.

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1. "Positive" and "coercive philanthropy" to
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merica: Struggles and Strategies to 1940
, 1982), 39; and Mary Ann Dzu-
AAUW, see Marion Talbot
ory of the American Association
flin, 1931).
Wendy's, Women Scientists in America: Before
Johns Hopkins University Press,
and Strategies; Marilyn Bailey Ogil-
teenth Century: A Biographical
 Mass.: MIT Press, 1986); and
Decades of Debate over Technical
11 January 1938; Louise P. Hor-
240, AC 4, Massachusetts
(thereafter cited as MITA). For
Predominate: The History of
, Women's Studies Quarterly 28
1, 1940, 1.
ook, 1941, MIT.
Ward Stiles to Compton, 3 Feb-
all three in file 18, box 210, AC4,
Stratton, 24 October 1956; memo
students," 24 January 1957; Roland
B. Greeley to Devrie Shapiro, 4 October 1961; all three in "Women Students," box
116, AC134, MITA.
8. Memo from Everett Baker, 26 January 1947, file 12, box 26, AC4, MITA.
9. Stiles to Carroll Webber, Jr., 28 March 1946, file 2, box 2, AC220, MITA.
11. Christina Jansen, interview by Shirlee Shirkow, 1977, box 9, MC86, MITA.
14. Hamilton to Stratton, 14 November 1956, box 2, AC220, MITA.
15. Margaret Alvort to Hamilton, 21 June 1956, box 2, AC220, MITA.
17. Memo from J. R. Killian, Jr., to Stratton, 22 October 1956, file 7, box 1, AC4, MITA.
18. Press release, 12 April 1960, MITA; see also press release, "Residence for Women Students at the Massachusetts Institute of Technology," n.d. (ca. 1963); and "A Tribute to Katharine Dexter McCormick," 1 March 1908; all in file "women students," box 116, AC134, MITA.
22. This Is MIT, 1963-64, file 2, box 4, AC220, MITA.
23. Memo from Jacquelyn A. Mattfeld to Malcolm G. Kispert et al., 21 January
1964, file 2, box 4, AC220, MITA.
25. Academic council, minutes of 2 March 1965, box 1, AC134, MITA.
27. Association of Women Students, This Is MIT for Women, 1963-64, file 16, box 85, AC118, MITA.
30. Association of Women Students, This Is MIT for Women, 1969-70, file 16, box 85, AC118, MITA.
31. Mildred Dresselhaus, interview by Shirlee Shirkow, 1976, box 8, MC86, MITA.

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32. Ad Hoc Committee on the Role of Women at MIT, report, n.d. (ca. 1972), box 13, MC485, MITA.
33. Association of Women Students, flyer, November 1974, file 14, box 1, AC220, MITA.
34. Emily Wick to Paul Gray, 16 November 1971, "MIT," box 13, MC485, MITA.
35. Ad Hoc Committee on the Role of Women at MIT to J. Daniel Nyhart, 28 February 1972, "MIT," box 13, MC485, MITA.
36. Sheila Widnall, interview by Shirlee Shirkow, 1976, box 8, MC86, MITA.
37. Walter McKay to Greeley, 4 May 1972; "Women in Engineering," film draft proposal, 27 June 1974; both in "Films—Women in Engineering," box 57, AC12, MITA.
40. Holliday Heine to James Mar, 14 November 1979, "Ad Hoc Committee on Women's Admission," box 13, MC485, MITA.
44. Pamphlet, 1958, in "Women in Engineering," box "SWE bio/subj.," SWEC.
50. Starting in the 1960s, SWE also presented financial prizes and certificates of
merit to high school girls who had demonstrated excellence in math or science or who had presented outstanding technical exhibits at local or national science fairs. As a separate example of women's engineering philanthropy, it is worth noting that Zonta International, a service organization of executive and professional women, in 1938 began awarding annual Amelia Earhart Fellowships to women for graduate study in aeronautical engineering or aerospace science (SWE Newsletter, March 1978).

51. Purdue flyer, n.d. (ca. 1970s), "Student Activities 1974–75," box 70, SWEC; and "Progress Report: Women in Engineering at Purdue Univ.," n.d. (ca. 1978), "Women Engineering Students," box "SWE bio/subj.," SWEC. Many other universities established programs with similar elements; for example, SWE chapters at Ohio State and Lehigh ran "big and little sisters" programs during the 1970s.


57. "Tinker . . . Toys . . . Technology," brochure, n.d. (ca. fall 1982), "A-V material," box 133, SWEC. See also Deborah S. Franzblau, "Have You Considered Outreach?" U.S. Woman Engineer, December 1980, 15. To note two similar examples among many, the SWE section of the Lawrence Institute of Technology made presentations to Detroit girls, while the University of Michigan's SWE worked with the Ann Arbor school system's career planning office to give talks at elementary schools and at junior and senior high schools.
