



WOMEN'S INITIATIVE
MASSACHUSETTS INSTITUTE OF TECHNOLOGY

Encouraging the Exploration of Engineering

*Sponsored by Microsoft Corporation &
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Women in Engineering

According to a 1996 report published by the National Science Foundation (NSF)¹, a significant disparity exists between the percentages of women and men in non-technical fields in education and industry. Women comprise 51% of the US population and 45% of the US labor force, but account for only 22% of employed scientists and engineers. At the undergraduate college level, women still tend towards study of non-technical fields more commonly than technical ones. Women earn more than half of all bachelor's degrees in social sciences, however, they earn one third of the bachelor's degrees in mathematics and physical sciences, and only 16% in engineering majors. Women earn an even smaller fraction of graduate degrees in science and engineering.

An even smaller percentage of women exist in the engineering workplace than in undergraduate engineering education. This reality has been attributed to two main factors. First, women often cite family-oriented reasons for taking time off from work and say that the engineering industry is not conducive to such leaves of absence due to the incredibly fast rate of change in technology. Second, women, more often than men, choose to enter other fields such as law, medicine, and education after obtaining bachelor's degrees in engineering.

Studies have also attempted to trace this disparity back to the high school level. Although male and female high school students do not differ significantly in the science courses they take, male students are much more likely than female students to take physics classes -- advanced physics classes in particular. According to the Dean of Admissions at MIT², many math and science magnet high schools have roughly equal enrollment by gender. Most of the women from these schools, however, choose not to study math and science fields in college. Instead, they pursue courses of study in liberal arts, medicine, and law.

Inception and Purpose of the MIT Women's Initiative

In the spring of 1998, Microsoft challenged the MIT Chapter of HKN to propose methods of addressing the lack of women enrollment in EECS (Electrical Engineering and Computer Science) studies and industry. A committee of four HKN students investigated the issue and proposed two programs, one of which called for presentations at high schools across the country, and came to be known as the Women's Initiative. The Women's Initiative was proposed to address problem of low enrollment in EECS by women early their career decision-making process -- when high school women are exploring potential majors and careers as they choose their path of higher education.

For this 2002-2003 year, the directors have continued to promote the program's focus from educating students about Computer Science and Electrical Engineering to encompass the expansive breadth of engineering. Presenters come from several different engineering disciplines and share their experiences with students from their various perspectives. We, as the directors, believe that this increases the overall value of the presentations immensely and allows presenters to identify with more of the high school students we visit.

¹ "Women, Minorities, and Persons With Disabilities in Science and Engineering: 1996," National Science Foundation.

² This information was provided by Marilee Jones, MIT Dean of Admissions, in a discussion with Austina Debonte in May 1998.

The rationale behind the Women's Initiative underscores the importance of creating personalized interactions between high school women and college women. By meeting female role models in Engineering, high school women will be more likely to seriously consider these fields as career options. Additionally, high school women identify more closely with college students than with college recruiters and industry professionals. Showing the enthusiasm and passion MIT women have for their work and demonstrating their projects will help combat the notion that engineering is a boring and uninteresting field.

The Presenters and the Presentations

During the month of January, enthusiastic women selected from the School of Engineering at MIT make presentations nationwide with the goal of encouraging women to consider studies and careers in engineering. The presentations include activities to engage students in thinking about engineering concepts, demonstrations from projects the presenters work on at MIT and in summer internships, information about the breadth of engineering fields, and the life of an engineering student. The presenters also incorporate personal stories about how they chose their fields of study as well as anecdotal stories about women in engineering. The Women's Initiative is intended not to recruit for MIT but to provide information and encourage high school women to consider the field of engineering.

The Effects of the Program

In order to gauge the effectiveness of the Women's Initiative, students complete surveys after the presentations, and a comprehensive analysis of the surveys is compiled in a separate report. These surveys evaluate the presentations and, more importantly, seek to determine the effectiveness of the presentations in persuading high school women to consider engineering.

Surveys collected from the January of 1999 presentations showed that most students, especially the girls, felt that their knowledge of and interest in EECS increased. Also, many girls commented that it was empowering to meet knowledgeable, personable, and confident women who are successful in technical fields. Many students who had not previously considered EECS as potential careers said that they would now explore the possibility. (For more information on the results, see Project Statistics section and "MIT Women's Initiative 1999", Fletcher).

The Contact Person

We view our program as a partnership between teachers and presenters to better educate the future engineers and scientists of this nation. Without the help of teachers and administrators, this program would not reach the large number of students, have the strong impact, or open as many minds as it can with the help of motivated teachers.

Recognizing the degree of impact teachers have on this program, we look for regions of the country that have teachers that are supportive of and enthusiastic about the program. Since its not feasible for us to locate and talk to all teachers in various high schools in a particular region, we require that there be **one contact person per region** that the directors contact, and who helps to organize the schedule for presentations in the whole region. We also require the name of a teacher at each school for the presenters to contact to discuss the presentation room, necessary equipment (overheads, floor space, etc.), and for the presenters to contact when they arrive at the school. The Contact Person is crucial to

smooth operation of the presentations in a particular area. The contact person serves as the only contact between the program directors and the eight or nine schools that will be visited by the presenters. The contact person must:

- ◆ Help schedule the presentations with teachers at all high schools to be visited
- ◆ Guide the presenters in terms of places to stay in the area, driving times and directions
- ◆ Be available to answer any questions presenters may have while visiting your region

Target Audience

Though our goal is to increase the number of women that consider engineering, we also realize that young men greatly benefit from the program -- both in the presented information, and in meeting successful women in the technical arena. We prefer to reach as many women as possible per class, but we leave it to the discretion of the teachers to determine the best way to reach their female students. In the inaugural year, we visited classes of all women that were all pulled from their classes during a certain period. We have also gone to classes with as few as 30% women present. We also prefer to let the teachers decide the time at which the presentations take place. To accommodate the interactive activities we conduct, we prefer class sizes of no more than 40 to 50 students.

Some schools preferred to have one presentation at an after school club meeting, while other schools allotted an entire day for multiple presentations. Typical audiences included advanced math and physics classes, computer classes, and club meetings for science or math related groups. How students receive the presentations is largely dependent on both the teachers' enthusiasm and students' interest.

We also leave it to the teachers' discretion to determine the caliber of the students invited to attend the presentations. A certain level of focus on education and desire to excel in the future is necessary to reap the greatest benefit from these presentations. We have found that going to mid to upper level math and science classes have, in general, had the greatest impact on the largest number of students.

Support of Teachers

The enthusiasm of teachers from our initial correspondence until we finish our presentation dramatically affects the way the presentations are received by students. When teachers are initially excited, the entire correspondence between the program directors and the teachers runs far more smoothly. Subsequently, the students get excited in anticipation of the presenters arriving, begin thinking more deeply about the engineering and ask more probing questions.

Pictures

During the presentations, we generally request that the teacher take picture of the students during the presentation for our own records, and to potentially be used in informational brochures or web pages which tell about the program's goals. To use these pictures in our materials, we are required to have the student's and their guardian's written consent. When a picture is selected, we send permission slips to the teacher to be given to the student(s) in the picture.

Funding

The Microsoft Corporation funds the entire program. No costs are incurred by the presenters or the schools visited.

Project Statistics

In the first year of the Women's Initiative, 18 MIT women studying EECS visited 42 high schools in ten states across the country. They held over 70 presentations and spoke with more than 1,800 students, of whom nearly 1,400 were female. In the second year of the Women's Initiative, 25 MIT women studying EECS held over 150 presentations and spoke with more than 4,000 students, over 60% of whom were female. This last year once again over 150 presentations were made with positive feedback from our audiences. After the presentations the majority of the high school students completed surveys.

Survey Results

On the surveys, the students were asked to describe their perceptions of EECS and engineering prior to the presentation. Of the female students, only 13% described EECS in positive terms before the presentations, while 43% regarded EECS in negative terms. Most commonly, the girls indicated that EECS seemed boring and too difficult for them or that there were very few opportunities in EECS. In contrast, 25% of the males responded positively to this question, and 23% of the males responded negatively. The remaining students either did not reply to this question or responded in a neutral manner. After the presentations, however, the overall tone of these perceptions became more similar between girls and boys: 78% of the girls and 71% of the boys viewed EECS in a positive manner, while only 6% of the girls and 1% of the boys made negative comments about EECS. Most students noted that they were surprised to learn about the breadth of EECS and its interdisciplinary applications, the many job opportunities in EECS, and the interesting projects undertaken within EECS.

The students also rated the presentations very highly in terms of the overall quality of the presentations, the knowledge and interest they gained in engineering, their identification with the presenters, and the interactive format of the presentations.

Quotes From Students and Teachers (1998-1999):

One girl in Connecticut originally expressed an interest in environmental studies and law. After the presentation, she wrote, "I now have a totally different view of these fields [EECS]. I see the ingenuity and creativity of these subjects and realize the many opening facets of such a field. I had no idea the interest I would pick up for such a subject as engineering or that I would truly consider it as a branch of *my* future. Surprisingly for me, I am really going to look into incorporating environmental work and engineering."

One girl in Texas taking advanced math classes wrote, "I am intimidated by the computer science field because of all the math and science involved.... I am much more informed now and definitely more interested. You make it seem much easier to accomplish!"

After participating in a game to act out the functions of a microprocessor, a senior in Florida wrote, "I thought that it [engineering] would be too difficult to understand and that I would be the only one that didn't know everything if I choose engineering as my major. It was nice to realize that I could understand some of the processes that take place."

A senior in California wrote, "I knew that the fields were very male dominated, but I *heard* that there were a lot of opportunities for women." After the presentation, she wrote, "I *see* that women have opportunities in the field." [emphasis added]

One girl in Connecticut wrote, "I have never really met any women who are interested in computer science or electrical engineering. I have never met anyone from MIT either. I had a different idea of these people before [the presentation]."

A junior in Florida wrote, "[The presenter] was really cool. She showed me that a minority female can be able to make it through a rigorous program such as MIT."

A girl in Texas, who had never really thought about engineering before, wrote, "Doing something in engineering could be something I see myself doing in the future."

One teacher in Massachusetts wrote, "There is a definite need to encourage women to enter these fields. Young women need to know that anything is possible and need to have role models to reinforce that idea.... you certainly have met those needs."

The Computer Technology Magnet Program Coordinator at a high school in Texas wrote, "This presentation has made me want to put more effort into exposing the students to professionals in this area of study so that they will learn more and, possibly, be more motivated to study engineering."

Quotes from Students and Teachers (1999-2000):

A junior from Evergreen HS wrote that the presentations "changed [her] career plans. I decided that I'm going to explore engineering."

A freshman from Ballard HS wrote that she is now thinking of "going into computer science!"

A Senior at Central Kitsap HS wrote that before the presentation, "[Engineering] sounded interesting, but somewhat nerdy or boring." After the presentation he said, "It sounds much more like a team environment with collaboration and interesting ideas."

A Teacher at Central Kitsap HS wrote, "I'm glad you're doing this! It helps students to see the uses of their studies and provides motivation!!...The two women presenters worked very well together...Students paid close attention to them."

A teacher at Glendale HS in Arizona wrote "Thank you so much for presenting to our students. Your presentation was excellent for both the large group and the small group...my students told me that they understood the presentation. Many times presenters speak 'over their heads.'"

A freshman from Arizona wrote that before the presentations, she thought, "You have to be a genius, nerdy, and have to be good at all subjects." After the presentations, she wrote, "I see the two presenters and they seem cool and laid back. Not dorks. They are people you would normally be my friends."

A teacher at Glendale HS wrote "Thank you so much for coming to our school. The presenters were wonderful, energetic, creative, and willing to adapt their presentation to fit our situation. The prizes and software were great – the kids really appreciated them. These presenters truly did change our perceptions of engineers!"

A senior at Central Kistap HS wrote that before the presentations she had a "very vague understanding of what engineering jobs actually encompassed," and afterwards that "there

are a multitude of divisions and paths. Not just technology on a computer, in a cubicle all day.”

A junior from Desert Vista HS wrote that the presentations taught her that “I can do whatever I want to do if I really want to do it!!”

A seventh-grader from Kenwood Academy wrote, “[The presentation] showed me that being an engineer is fun, and very interesting. Now, I’m considering studying computer science in college.”