

UNDERGRADUATE ENGINEERING DIVERSITY COURSE

Undergraduate Engineering Diversity Course: Women and Men

In The Engineering Workplace

Carolyn D. Heising and Mary E. Goodwin

Iowa State University

Abstract

An undergraduate engineering diversity course, entitled: “Women and Men in the Engineering Workplace”, was offered as an experimental course in the spring semester of 2003 in the College of Engineering at Iowa State University (ISU). The course was cross-listed with the ISU’s Women’s Studies Program, and is believed to be the first such engineering diversity course in the nation, and perhaps the first women’s studies course to be offered by an engineering college. The students were “recruited” by the instructors representing the college’s eight engineering departments, and were predominantly upperclasspersons. In order to ensure a gender balance in the class itself, the enrollment was ‘engineered’ so that half of the class was men, and half women. Although the course was centered on increasing gender diversity in the historically male dominated profession of engineering, race and class aspects of diversity were also dealt with in the class. Topics included studying masculinity in America, how gender is constructed in our society and the history of engineering education with regards to gender.

Undergraduate Engineering Diversity Course: Women and Men In The Engineering Workplace

The class relied heavily on guest lecturers from the college of liberal arts and sciences at ISU, and from the ISU Women's Studies Program. The course had to be approved through a lengthy curriculum approval process to meet ISU's United States diversity requirement. In this paper, the course content, course preparation, and classroom experiences are described.

Course Development Process

The idea for the development of an engineering college course to meet the university U.S. diversity requirement at ISU emerged after the authors were invited to speak on a panel of women engineers in a related course that has been offered for many years at ISU within the college of liberal arts and sciences (LAS). This course is entitled: "Women in Science and Engineering", and is also a 300 level undergraduate course aimed primarily at women students in the sciences and engineering. Taught by zoology professor, Dr. Eugenia Farrar, who is also an affiliated faculty member of the ISU Women's Studies program, this course was cross-listed as a women's studies course as well as an upper level undergraduate zoology course. When the authors were invited by Dr. Farrar to participate in a panel on women in engineering, the authors found that the large majority of students enrolled in the class were scientists, and only two students that semester were engineers. As the authors related their experiences as women engineers to the class, it was clear that a large gap in the types of experiences existed between the woman scientist and the woman engineer, particularly if the woman scientist was in the life sciences (biology, etc.). Thus, based on early conversations the authors shared as a result of participating on the panel in Dr. Farrar's course, it was concluded that perhaps the engineering

college should develop and conduct its own diversity course that would be not only targeted at women engineering students, but at men engineering students as well.

A second influence in the authors' decision to pursue a separate diversity course for engineering students dealing with a focus on gender issues developed when one of the authors (Dr. Heising) participated as an invited lecturer in a new sociology course, also cross-listed with women's studies, entitled: "Masculinities and the Sociology of Manhood" taught by ISU sociology professor, Dr. Sharon R. Bird, (Dr. Heising was asked to speak on her experiences as a woman in a traditionally man's profession in that class). Later, Dr. Heising also asked to sit in on Dr. Bird's new course, which has lead to a close collaboration. Dr. Bird later was invited to give guest lectures on the topics of gender and specifically, masculinities studies in sociology in the new engineering diversity course. These were very well received, especially by the men engineering students in the class.

A third influence in the authors' decision to pursue a separate diversity course for engineering students was the scholarly work and course of ISU history professor, and women's studies affiliate, Dr. Bix, who has been writing a book on the history of women's engineering education in the United States. Dr. Bix also teaches a diversity course on the history of women in science and engineering which Dr. Heising participated in prior to the offering of the engineering diversity course. Dr. Bix later provided guest lectures in the engineering diversity course related to the history of women's engineering education, which complemented the visiting Society of Women Engineers (SWE) exhibit during women's history month in spring, 2003, on the history of SWE and women in engineering in the U.S.

Finally, the last influence on our decision to pursue a separate diversity course for the engineering college was an NSF sponsored conference hosted by the ISU Women's Studies

program in October, 2002, which was in development for the last several years at ISU. Dr. Heising, as well as Drs. Farrar, Bird and Bix, were heavily involved as co-conveners of the conference, which involved the participation of twelve engineering colleges in the Midwest. This conference provided a wealth of information on the status of women in engineering, and the barriers and challenges facing women in pursuing careers in science, math, engineering and technology (SMET) fields. Scholarly work based on conference participation was also substantially utilized in the engineering college diversity class, including the works of several internationally known experts on women in SMET fields.

Course Delivery Experiences

Once the course content was agreed upon by consultation with several of the aforementioned instructors and research professors, the course went through an extensive approval process that is required of any diversity course. This process included receiving approval from the department offering the course, the engineering college, the women's studies department and their college (LAS) along with the chair of the faculty senate. From ISU's website, the university defines a "diversity" course in the following way;

The focus of the U.S. Diversity requirement is the multicultural society of the United States. Courses or alternative academic work used to meet the requirement address significant manifestations of human diversity and provide students with insights that enhance their understanding of diversity among people in the U.S.

Approval was received in the fall of 2002, and the course was slated for first delivery for the spring 2003 semester. At this time, the authors plan to continually offer the class each spring semester. It was decided that the course would be capped at 30 students, and that the course be populated by an equal number of men and women engineering students. As an official industrial

engineering course, it also cross-listed as a women's studies course. The experience for the students of an equal gender distribution in an official engineering course would also be part of the experience. As the authors found out later, several of the men students who attended in fields of engineering where the percentage of women undergraduates remains relatively low (i.e.; less than 10%) remarked that this was their first classroom experience with so many women engineering students and they enjoyed having a larger percentage of women in their classes. Thus, the course itself was structured so that the even gender balance in the classroom itself affected the delivery and receptivity of the students to the materials presented.

The course consisted of several topics that were delivered by recognized faculty experts in the field, and who were mostly affiliated faculty members of the ISU Women's Studies program. The topics and instructors included: gender in communications (Dr. Jane Vallier, ISU English department), gender and women's studies (Dr. Jill Bystyzienski, Director, ISU Women's Studies program), history of women in engineering (Dr. Amy Bix, ISU History department), masculinities studies (Dr. Sharon Bird, ISU Sociology department), work and family balance (Dr. Connie Post, ISU English department). Also, several engineering faculty and staff participated in the class as instructors in the following areas: gender schemas and leadership (Ms. Mary Goodwin, CoE staff), racial diversity in engineering and the ISU LEAD program (Ms. Rosa Bell, CoE staff), affirmative action in engineering (Dr. Derrick Rollins, chemical engineering professor), and women professors of engineering experiences (Dr. Jackie Shanks, chemical engineering professor/Dr. Judy Vance, mechanical engineering professor). Also, Dr. Vance gave a week of lectures related to women in engineering leadership based on her recent NSF Women in Engineering Leadership (WELI) grant. Also, several engineering leaders in the ISU student section of the Society of Women Engineers (SWE) and the National Society of

Black Engineers (NSBE) gave talks on their organization's national, local and student section efforts in furthering diversity goals in the engineering profession.

Objectives and Outcomes

One of the objectives of the course is to increase the participation and retention of women and minority engineering students. Another objective is to increase engineering students' awareness of gender in their lives and in the workplace. As an outcome, students will learn about the engineering workplace and the different experiences that men and women have as a result of their gender. Another outcome is that by understanding the construction of gender and gender communication, the students will be able to communicate more successfully in a work environment in addition to creating a positive work environment that does not favor one gender over another. A longer term outcome then would also be the retention of women engineers in the workplace. Assessment is ongoing and will be done through interviews with students who have been in the workplace for at least a year.

Class Topics

The following subjects were each covered in class over a period of one to two weeks: gender communication; including *A Male/Female Continuum* (Pierce, Wagner, Page, 1988), understanding "Collusion of Dominance and Subordinate" (Pierce, et al. 1988), feminine and masculine stereotypes in speech patterns, gender patterns in talk in such areas as vocal behaviors, verbal constructs, and nonverbal behavior (Ivy, Backlund, 2000). The history of gender in engineering covered in detail the exclusion of women from engineering at universities, the societal changes that occurred to bring women into engineering and the reaction on university campuses to women engineers in addition to exploring the early gender construction of engineering (Frehill, 2003). The class spends about two weeks on the social construction of

gender, covering men's mobilizing masculinities in work organizations that marginalize women, hegemonic masculinity, gendered practices among men and women in everyday activities and understanding "doing gender". One week is spent reviewing Valian's work on gender schemas and the concept of "accumulation of advantage" (1998). Approximately two weeks are used to review the portrayal of men and women in the media and its effect on our society; this includes reviewing and discussing parts of the video "Tough Guise" with Jackson Katz (1999). An addition, at least one week each was spent on ethnic diversity in engineering, leadership and gender, family and work balance issues, and real life stories by men and women engineers.

Class Assignments

Class time consisted of a mixture of presentations and group discussions by the students. No exams were given in the class. Instead, the grading of the class consisted of written papers and two team projects. Students were asked to write one to two page reports on several articles that were distributed in class. Some of these articles included the following; "Welcome to the Men's Club: Homosociality and the Maintenance of Hegemonic Masculinity", (Bird, 1996), "Subtle Sexism in Engineering" (Frehill, 1997), "Sex and Suits" (Hollander, 1994), "Gender as Structure", (Risman, 1999), "Mobilizing Masculinities: Women's Experiences of Men at Work" (Martin, 2001), "Perspectives on Masculinities" (Kimmel, 2001), "Hegemonic Masculinity and Emphasized Femininity" (Connell, 1987) and "Men of Reason" (Connell, 1995).

In addition, students were asked to read selected chapters from the following books which were also the required texts for the class: *Women in Engineering: Gender, Power and Workplace Culture* (McIlwee and Robinson, 1992), *Men and Women of the Corporation* (Kanter, 1993), *The Time Bind: When Work Becomes Home and Home Becomes Work* (Hochschild, 1997), *Workplace/Women's Place* (Dubeck, 2002) and *Becoming Leaders: A Handbook for Women in*

Science, Engineering and Technology (Williams, F. M., & Emerson, C. J., 2002). After having group discussions on these chapters, students were asked to hand in a two to three page typed summary of the discussion and the chapter read.

For example, from Dubeck and Dunn's book, *Workplace/Women's Place* (2002), Students were asked to read the chapter titled, "Sex Segregation in the Workplace" and write a paper addressing the questions at the end of chapter. Another assignment asked students to read chapter one in *Women in Engineering* (McIlwee and Robinson, 1992) for an in-class discussion focusing on the question: is the promise being fulfilled for women in engineering as a significant career opportunity? Students then were to type a two-page paper summarizing their discussions. In Kanter's book, *Men and Women of the Corporation* (1993), students were asked to read the afterword from the 1993 edition: "How the Global Economy is Reshaping Corporate Power and Careers" and to again submit a two page typed summary of their in-class group discussion.

Students were asked to do two group projects (one for the midterm and the other for the final) with a 15-minute group presentation included. The in-class midterm project consisted of a presentation on how "doing" gender is "performed" in the engineering workplace and a ten page typed report on what they found. Students were to observe engineers in the workplace, how each gender dressed, to look at trade publications and corporate websites to see how each gender was represented. Students were asked to wear their suits to class and many performed skits in class relating to gender in the workplace.

Student Responses

From the student's writings, the authors noticed the enthusiasm and the learning that was taking place. Many students began to pay attention to how gender and hegemonic masculinity affected their everyday life. One male student wrote after attending a lecture by Kimmel, "It's

one thing to impress females but guys put far more pressure on themselves to be better than other males. I'd never really thought about this concept but I think it's dead on."

Another male student wrote after reading "Introduction: Toward a History of Manhood in America" (Kimmel, 1997);

I felt like I could make a difference in the future of how women are treated in everyday life. I also gained some valuable insight into something that I can do later in life, such as when I become a family person.

One female student wrote after reading "Mobilizing Masculinities" (Martin, 2001);

I definitely agree with the author that to fix this problem people need to be aware that they are doing it. If we aren't aware that we are unconsciously excluding women from the workplace, we won't be able to fix the problem. This article made me aware of how men think in the workplace. This really shocked me but now I am able to use this information to help me succeed at my job.

Another female student wrote after reading "Perspectives on Masculinities" (Kimmel, 2001);

I believe that the main focus of this paper was to show how males have to deal with a standard for how a man is supposed to be. Like females trying to achieve perfect grades, a perfect body, a perfect social life and a perfect job, males also work towards the ideal.

One of our guest speakers who is the highest-ranking African American with the Iowa Department of Transportation, sent an email (M. Kennerly, personal communication, April 25, 2003) to the authors after visiting the class. It said in part;

I appreciated the opportunity to speak to your class and I applaud ISU for offering this course. As an African American the issue of diversity is a personal one, but as a manager and supervisor it is a professional one as well.... The face of tomorrow's workforce will be much

more diverse than anything we have seen in the past and these students need to be prepared to embrace diversity, which is a far cry from where we are today.... As the courts stand ready to deal Affirmative Action another setback...now more than ever we need a course like this. Prejudice is the result of ignorance and fear. The only way to remove ignorance is to educate.... The education they get in diversity while at ISU will be the foundation they build on throughout their career. What goes into that foundation will determine whether they and we can move from accepting diversity to embracing it. And by embracing diversity what I mean is we seek it, we value it, and we understand its importance.... But in order to embrace diversity you have to appreciate and value what everyone brings to the table, which is why I think this course is so great. It brings students together of both genders, and different ethnic and racial backgrounds to open a dialogue that will allow education to begin, and where education exists the ignorance and fear that still plagues our society will begin to die.... Although I am a U of I (University of Iowa) grad I am proud of what ISU is doing, and I am glad that our state was one of the first to offer a course like this for engineering students. I was recently asked to serve on the Advisory Board for the Civil Engineering College at the U of I and I plan to share this information with them in hopes that they will follow your lead.

Conclusions

To summarize, the development, approval and first delivery of an experimental undergraduate diversity course for engineering students directed and taught by engineering faculty, staff and selected student leaders, as well as by experts in diversity topic areas, largely from the ISU liberal arts and sciences colleges and the ISU Women's Studies program, was achieved in the spring semester of 2003. This course was very well received by the engineering students who participated, and those attending had many rewarding experiences. It is

recommended that other engineering colleges consider offering a similar course to undergraduate engineering students not only to enhance the knowledge and preparation of future engineers and corporate managers in the ever important area of diversity training, but also to enhance the efforts of the engineering profession in promoting goals of diversity.

References

- Bird, S. R. (1996). Welcome to the men's club: Homosociality and the maintenance of hegemonic masculinity. *Gender & Society, 10*, 120-132.
- Connell, R. W. (1987). Hegemonic masculinity and emphasized femininity. In *Gender and power* (pp. 183-190). Stanford: Stanford University Press.
- Connell, R. W. (1995). Men of Reason. In *Masculinities* (pp. 164-181). Berkeley: University of California Press.
- Dubeck, P. J., & Dunn, D. (2002). *Workplace/Women's place*. Los Angeles: Roxbury Publishing Company.
- Frehill, L. M. (1997). Subtle sexism in engineering. In *Subtle Sexism: Current Practice and Prospects for Change*. London: Sage Publications.
- Frehill, L. M. (2003). Gendered construction of the engineering profession in the United States, 1893-1920. *Men & Masculinities*.
- Hochschild, A. R. (1997). *The time bind: When work becomes home and home becomes work*. New York: Holt Co.
- Hollander, A. (1994). *Sex and suits: The evolution of modern dress*: Random House Inc.
- Iowa State University, (2003). *U.S. Diversity/International Perspectives Requirements*. Retrieved October 16, 2003, from <http://www.iastate.edu/~registrar/courses/div-home.html>
- Ivy, D. K., Backlund, P. (2000). *Exploring genderspeak*. Boston: McGraw-Hill Higher Education.
- Kanter, R. M. (1993). *Men and women of the corporation*. New York: BasicBooks.

- Katz, J., & Jhally, S. (1999). *Tough guise: Violence, media, & the crisis in masculinity*. Northampton: The Media Education Foundation. (Available at www.mediaed.org)
- Kimmel, M. S. (1997). Introduction: Toward a history of manhood in America. In *Manhood in America: A cultural history* (pp. 1-10): Free Press.
- Kimmel, M. S., & Messner, M. A. (2001). Perspectives on masculinity. In. (Ed.), *Men's Lives* (5th ed., pp. 1-3). Needham Heights: Allyn and Bacon.
- Martin, P. Y. (2001). Mobilizing masculinities: Women's experiences of men at work. *Organization*, 8(November), 587-618.
- McIlwee, J. S., & Robinson, J. G. (1992). *Women in engineering; Gender, power, and workplace culture*. Albany: State University of New York.
- Pierce, C., Wagner, D., & Page, B. (1988). *A Male/Female continuum: Paths to collegueship*. Laconia: New Dynamics Publications.
- Risman, B. J. (1999). Gender as structure. In *Gender vertigo: American families in transition*. Hartford: Yale University Press.
- Valian, V. (1998). *Why so slow: The advancement of women*. Cambridge: The MIT Press.
- Williams, F. M., & Emerson, C. J. (2002). *Becoming Leaders: A handbook for women in science, engineering and technology*. New Foundland, Canada: Memorial University, St. John's.

Author's Note

Carolyn D. Heising, Industrial and Manufacturing Systems Engineering, Iowa State University; Mary E. Goodwin, Engineering Undergraduate Programs, Iowa State University.

Correspondence concerning this article should be addressed to Carolyn Heising, 2019 Black, Department of Industrial and Manufacturing Systems Engineering, Iowa State University, Ames, Iowa 50011-2164. E-mail: cheising@iastate.edu