

## EXPLORING THE ACADEMIC ENVIRONMENT FOR WOMEN IN ENGINEERING

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### Introduction

Recruiting and retaining women in engineering are important goals for academic institutions of engineering and U.S. industry. However, the academic environment that these women are recruited into must also be responsive to the needs of all its students (including women and minorities). If institutions do not examine and modify their engineering academic infrastructure, they will not be making systemic changes towards long-term solutions to the problems of the under-representation of women in engineering. For this reason the College of Engineering and the Center for Women in Engineering at the University of California at Davis (UCD) are committed to improving the institution and learning environment for future generations of students.

One expression of our commitment to change is the development of a faculty workshop for engineering. We gratefully acknowledge financial support for this project from the National Science Foundation (NSF) (Grant #HRD-9053903). These workshops are also supported and advocated by the Dean of the College of Engineering and the Dean of Graduate Studies. A grant by the Fund to Improve Post Secondary Education (FIPSE) is allowing us to utilize our results with educators at the K-12 years.

Our experience with women in UCD engineering programs parallels the insights detailed by the Campus Climate studies done by the Project on the Status and Education of Women.<sup>1</sup> Many of the programs developed by our center focus on students, helping them to understand and succeed in their engineering careers. Our faculty workshops focus on the other side of the student/faculty equation by helping faculty members understand that engineering is not a monolithic, gender-neutral environment. Rather, there are educational issues related to gender which they can be actively concerned about.

We set two primary goals for workshop participants: 1) faculty members should gain insight and appreciation for the difficulties of being a woman in engineering; 2) faculty members should be given concrete ideas and tips that they can use to improve their own teaching. A third goal, more procedural in nature, is the formulation of plans for mainstreaming this workshop model to be shared with other interested institutions and other non-engineering faculty bodies.

### Agenda

After our first workshop in May of 1992, we realized that to obtain our goals, planning and coordination needed to be thorough and precise. A task force was formed approximately 5 months prior to the workshop to guide the preparations. This

group was comprised of the Director of the Center for Women in Engineering, two female engineering faculty members and two male engineering faculty members and a professional evaluator. This task force was an innovation upon our first workshop which was organized and planned by the Director and the two female engineering faculty members. This larger and more diverse group added considerable depth and male as well as female perspectives concerning the effectiveness of alternate strategies to the planning process. Another significant finding from our early experience was that while gender equity is a specific issue, however, it is still too broad and diffuse to be the focus of a workshop topic. Everything about our second workshop needed to be focused, allowing all the participants time to ponder a few issues, to discuss them and feel comfortable with the topics. From our task force meetings and previous results, we put together the following agenda for our second faculty workshop (Table 1) which occurred on March 4, 1993.

8:00 - 8:15	Welcome - Vice Provost, Faculty Relations
8:15 - 9:00	Introduction to Academic Environment issues and ideas Director, Center for Women in Engineering
9:00 - 10:15	"Alphabet Challenge" - lighthearted sketches of academic interactions
10:15 - 10:30	Coffee Break
10:30 - 11:30	Student/Alumna panel and discussion
11:30 - 12:30	Small group tasks: assess ideas presented and develop action steps A working lunch will be provided at 11:30
12:30 - 1:00	Summary, Conclusions, Evaluations

Table 1. Sample Agenda for Faculty Workshop,  
"Exploring the Academic Environment for Women in Engineering"

### Getting Started

We believe it is important to ally as many constituents of the university system with these workshops and the work of the Center for Women in Engineering (WIE). Gaining supporters from many areas provides visibility, credence and authority to our efforts. Attendance at a workshop such as this is always limited due to numerous faculty commitments. We invited the entire engineering faculty body and a few guest participants from the Math Department, Chemistry Department and the Physics department for a total population of approximately 200. Thirty-four faculty actually attended the workshop. Approximately fifty people in total attended, including staff and panel members.

### Welcome

Our guest speaker for the welcome was the UCD Vice Provost for Faculty Relations, Carol Tomlinson-Keasey. Dr. Keasey's opening comments focused on her own research on gifted women and the difficulties they often encounter in science academia. During the welcome we introduced key members of the audience including Dr. Joan Straumanis, our program officer from the Fund to Improve Post Secondary Education (FIPSE), and Winnie Anderson from our campus Teaching Resource Center, both of whom acted as resource people during and after the workshop.

### Introduction of Academic Environment -Issues and Ideas

This presentation outlined the present and historical representation of women in science and engineering nationally and at UCD. The presentation clearly demonstrated the gender imbalances that occur in engineering. The introduction also addressed reasons as to why this imbalance still exists. We utilized a shortened version of the Gender IQ Quiz<sup>2</sup> to stimulate questions and ideas about common gender myths that exist. This presentation continues to be an important yet difficult component of the workshop. It tends to be less interactive and more didactic compared to other components, and yet is critical to setting the stage for the specific problems and solutions suggested later on. This presentation of statistical data on recruitment and retention of women in engineering is the portion that legitimates the issue and places it in the context of a national issue in engineering education as well as a specific UCD issue. The absence of this component would be severely detrimental to the overall process. Without it, some faculty would dismiss the relevance, significance and immediacy of the issues, even though some express impatience with this portion.

### Alphabet Challenge

"Alphabet Challenge" is a light hearted presentation from the drama department which is a new approach we used to graphically demonstrate some of the more common interactions that occur in academic settings between faculty and students as well as students to students. Frequently, these factors are not conducive to women's success as students and are a contributor to increased attrition rates for women. A graduate student from our Dramatic Arts department was hired to design and develop drama sketches of academic situations and coordinate a group of four drama students to perform these sketches for the faculty participants. The material they used to develop the sketches came from several local sources; a 1991 UCD Undergraduate Engineering Survey conducted by Center for Women in Engineering, UCD engineering faculty surveys and anecdotal information collected by the staff of WIE. Scenes from a lecture, a laboratory and office hours were acted to demonstrate a variety of settings. The sketches utilized several techniques to include audience participation, such as discussions with the actors remaining in character and reenactments of the sketches incorporating new ideas and solutions. This type of illustrated, interactive presentation helps faculty members see and identify behaviors and activities that can be improved. Since the illustrations are humorous and exaggerated, subtle behaviors are brought to the foreground and that faculty members are not put on the defensive by seeing activities that mimic their own classrooms too closely. Of all the survey respondents, 47% felt that this was the most valuable part of the workshop. Some of the comments about this component included: the humor tended to bring faculty together; the sketches provided concrete examples; and this activity generated good discussion and highlighted issues more clearly than mere words.

### Student/Alumna Panel discussion

The panel consisted of students and alumni with a variety of backgrounds and engineering disciplines. Panel members presented stories and examples of their own positive and negative experiences as engineering students. It is critical to select panel members who will not be made vulnerable or become jeopardized by this experience. Panel members are presenting their personal experiences to faculty members they may have had as instructors. For these reasons, I have found that graduating seniors, graduate students and alumni are most comfortable being a part of this panel. They often have the best comprehension of their experiences, can articulate their feelings

and do not feel vulnerable. We chose this panel in terms of diversity, disciplines, ethnicity and gender. The diversity provided greater impact to the workshop participants. Three important emphases for the panel were: to provide positive (as well as negative) illustrations; to use non-accusatory examples (i.e. How I felt as a student as opposed to what you did as a professor); and, finally, to cite non-specific examples that identified incidents rather than individuals. The panel is structured with 8-12 total members but utilizing only 4 or 5 to actually present five minute anecdotes illustrating their experiences. Following this we opened the floor to questions and discussion. The discussion was co-facilitated by a UCD male faculty member outside of the College of Engineering, skilled in facilitation and communication techniques as well as by the director of the Center for Women in Engineering. As a facilitator, the male faculty member was able to help the participants distinguish between the "sociology and the so-what". It can be cathartic to talk about the sociological theory, but at a workshop level we are concerned with the practical implications and applications. The large group of panel members provides a greater collection of experiences and perspectives, and they also provide a larger body of students for support and solidarity.

The main goals of the panel are to personalize and bring to life the concepts illustrated in Alphabet Challenge. These are current and past students talking about their experiences at UCD. This makes the issues more immediate and relevant for participants. There were many direct correlations between the examples provided by the panel and the concepts presented by the Alphabet Challenge. This was a valuable way to reinforce the topics being discussed. Of the participants, 42% felt this was the most valuable component of the workshop. Evaluation comments included: the panel was 'real'; and generated good discussion. A new faculty member appreciated hearing potential situations and problems.

### Small Group Tasks

This component was designed to allow participants to break into small working groups to discuss the topics presented during the previous sections, and to identify ideas that appeared most relevant and practical to use as a starting point for change. Their second task was to pool ideas and develop a list of concrete action steps they could use as teachers, scholars and colleagues to enact change. This very concrete conclusion to the workshop was missing from our first workshop and those participants voiced dissatisfaction with the nebulous conclusion. They wanted specific, concrete ideas, and tools they could utilize. Small groups presented their ideas to the large group as a summary and conclusion. Unfortunately, this activity did not work as well as expected because many participants needed to leave early and the scope of the topic was still too large for some people to begin exploring. In the middle of the small group activity, a booklet entitled "Ideas and Tips for enhancing your Classroom" was distributed to all participants with a more extensive list of ideas about specific ways to be conscious of gender issues, how to be more equitable, and how to improve the classroom environment. This booklet is designed to be a long term tool for faculty members to remind them of issues arising in their classrooms and solutions. While no one rated this as the most valuable component of the workshop, negative comments related to the lack of adequate time and the attrition of participants by this phase of the workshop.

### Evaluation Process

As mentioned previously, one of our goals is to develop a working model that can be used as a baseline for other faculty groups or institutions interested in sensitizing engineering faculty on gender issues in the classroom environment. Well documented information is critical to this process. Our project evaluator assisted in the

development and implementation of these workshops in order to guide the complete evaluation process. We started the process with a simple, one-question survey sent out to all engineering faculty, asking them to describe any interactions they had observed or been a part of where the actions or responses of the women were markedly different from the men. Although response rates for this survey are characteristically low, they have stimulated conversation, provided us with ready anecdotes and case studies, and serve as a prelude to the workshop invitation.

Evaluation during the workshop consisted of 3 elements. During the introduction, we provided faculty members with 3x5 cards and asked them to write down any specific questions or reservations they might have about the workshop topic so that we could attempt to address these issues during the workshop. These cards gave us some indication of the level of awareness and/or antagonism towards the topic. Several staff members attended the workshop with the specific task of observing the participants and the process to provide us with immediate feedback. At the conclusion of the workshop we requested that participants fill out an evaluation to give us their ideas about the workshop and what they learned from it. One question on the evaluation asked if the participant was willing to be a part of follow-up research. The majority of respondents (81%) indicated that they were willing. We plan to implement a modified Delphi Evaluation or a Nominal Group Technique with these members. We will develop a written tool for them to complete about their experiences with the specific ideas they received at the workshop approximately 6 months after the workshop. From their responses we will compile a single document of their comments and experiences and ask them to read through and to further elaborate upon the ideas generated and the success levels they have reached. Depending upon the success of this measure to generate a few key issues and topics for further expansion, we will hold focus groups with these faculty members.

#### Initial Findings

Of those returning our evaluation questionnaire, 37% gave the workshop an excellent rating (the highest possible) and 58% gave it a good rating (the next highest possible). Many excellent comments came from the evaluations, some of the most commonly mentioned included: a need for a wider group of participants; a recognition that we were 'preaching to the choir' and; that while everyone gained something from the workshop, many others would benefit from attendance at such a workshop. A second group of comments focused on specific activities that faculty members could utilize in their own academic situations. Many faculty mentioned that soliciting more feedback from their students early in the quarter would allow them to incorporate student ideas into their teaching style. Several others mentioned that they were consciously going to monitor the levels and types of interactions they had with students.

#### Lessons Learned

Presenting this type of a workshop to a faculty body has several difficulties. First, there is never a good time to hold a workshop. A five hour workshop is a significant amount of time and we did lose some potential participants to other commitments. We are currently exploring options for different formats. One strategy that is currently being piloted is a shortened version for Teaching Assistants, another group that also has a high contact level with students and can be very influential in student's academic satisfaction. It is also difficult to incorporate a mechanism that encourages widespread attendance. The first year we sent the invitation letter from the Dean of the College of Engineering, however, the 'choir' was the most readily in attendance.

We found it useful to set boundaries for the participants at the start of the workshop. These boundaries or caveats were reiterated throughout the sessions to provide continued guidance. The caveats included:

1. This workshop is important for everyone, both men and women. Women are just as prone to gender-biased teaching techniques as men.
2. We assume that educators at this workshop care about the quality of their teaching and their students. We do not imply that any educators are prejudiced, rather that there may be a lack of awareness about the difficulties that women face in their engineering education.
3. Our focus is on what faculty members as individuals can do to improve the academic environment for their students. It is not a workshop on what the larger institution or external bodies can do to address the problems.
4. While our focus is on gender issues, increased awareness of differences, and sensitivity to methods for incorporating difference into the classroom will benefit all your students.

For many faculty members the information presented at a workshop like this is rather controversial, and can be uncomfortable. It is a situation heightened by the fact that historically there have not been a large group of women faculty members who have helped to educate the male faculty members about some of these issues. A common coping method for anyone in an uncomfortable situation such as this is to deny complicity in the problem. During the first faculty workshop, the participants proved adept at implicating others to the exclusion of themselves. In the process they transferred the blame to pre-engineering courses (calculus, physics, chemistry), poor preparation in high school, the women themselves, etc. They also transferred the responsibility of solutions to other bodies such as the Center for Women in Engineering, course evaluations, an ombudsman, department chairs, SWE, etc. For these reasons we developed the caveats and narrowed our focus for the second workshop. While denial and transference still occurred, it occurred to a lesser degree the second year.

Having male faculty members participate on the steering committee and a male facilitator was also beneficial to the overall process. They were able to help reframe ideas and concepts in terms that other males could relate to more easily. It also sent a much stronger message to the engineering community that this is a universal issue as opposed to a women's issue.

### Conclusion

We believe that there is still room for improvement in both the design and dissemination of a format for workshops like this. The need is evident. Until we have developed comprehensive programs that examine and modify all of the factors that cause women to abandon their engineering education, we will not make significant inroads into making the engineering profession accessible for all people, especially women.

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<sup>1</sup> Sandler, Bernice R., et al., "Teaching Faculty Members to be better Teachers", "Looking for more than a Few Good Women in Traditionally Male Fields", "The Classroom Climate: A Chilly One for Women?" Papers from the Project on the Status and Education of Women from the Association of American Colleges.

<sup>2</sup> Adapted from Myra and David Sadker's GCQ 1985.