AC 2010-467: INSTRUCTOR AND STUDENT PERSPECTIVES ON A GRADUATE PROFESSIONAL DEVELOPMENT COURSE: CAREER ISSUES FOR WOMEN IN ENGINEERING

Keisha Walters, Mississippi State University

Dr. Keisha B. Walters is an Assistant Professor of Chemical Engineering at Mississippi State University. She received her B.S. degree in Biological Sciences from Clemson University in 1996 and her M.S. and Ph.D. degrees in Chemical Engineering from Clemson University in 2001 and 2005. Dr. Walters' research involves the development and surface modification of stimuli-responsive and bio-inspired polymeric materials. She has been a member of ASEE since 2002.

Adrienne Minerick, Mississippi State University

Dr. Adrienne Minerick is an Associate Professor of Chemical Engineering at Michigan Technological University having recently moved from Mississippi State University. She received her Ph.D. and M.S. from the University of Notre Dame and B.S. from Michigan Tech. Adrienne is an NSF CAREER Awardee and was the faculty advisor for MSU's NOBCChE chapter. Her research is in medical microdevice diagnostics & dielectrophoresis.

Soumya Srivastava, Mississippi State University

Soumya K. Srivastava is a Ph.D. Candidate in Chemical Engineering at Mississippi State University. She received her M.S. from Illinois Institute of Technology and B.S from R.V. College of Engineering (Bangalore, India). Her research involves building lab-on-a-chip devices for medical diagnostic applications under the direction of Dr. Adrienne Minerick. Soumya is an active member of AIChE, AES, ASEE, SWE, and Sigma-Xi.

Jacqueline Hall, Mississippi State University

Jacqueline I. Hall received a B.S. in Chemical Engineering from Mississippi State University in 2006. She is currently a Ph.D. Candidate at MSU in Chemical Engineering and scheduled to graduate in May 2011.

Kaela Leonard, Michigan Technological University

Kaela Leonard is a third-year Ph.D. student at Michigan Technological University having just recently transferred from Mississippi State University with her advisor, Dr. Adrienne Minerick. Her research interests are the areas of electrokinetics and microfluidics as they relate to medical microdevices.

Amy Parker, Mississippi State University

Amy Parker is a Ph.D. Candidate in the Dave C. Swalm School of Chemical Engineering at Mississippi State University. She received her B.S. degree in Chemical Engineering, also at MSU, in 2005. She is a member of the American Institute of Chemical Engineers (AIChE), American Chemical Society (ACS), Sigma Xi, and the Air & Waste Management Association (A&WMA).

Heather Thomas, Mississippi State University

Heather Thomas is a graduate student at Mississippi State University. She received B.S. degrees in Biochemistry in 2002 and in Chemical Engineering in 2007 from MSU, and will complete her M.S. in Chemical Engineering this year. Heather's research focuses on the life cycle assessment (LCA) of wood pyrolysis. She is a member of the American Institute of Chemical Engineers (AIChE), Air & Waste Management Association (A&WMA), and Sigma Xi.

Instructor and Student Perspectives on a Graduate Professional Development Course: Career Issues for Women in Engineering

Abstract

A discussion-based professional development course was developed and taught in Spring 2009 to a diverse group of female chemical engineering graduate students. The goal of this course was to assist the students in their professional growth by providing the opportunity for open discussion (group and one-on-one settings) combined with constructive and positive feedback. The students guided the course content and were active participants in the class discussions. Course structure and content are presented along with the tangible outcomes. The perspectives of the instructor and the students are presented side-by-side and offer a view of the effectiveness of a course geared towards increasing the students' career success. Self-examination and discussion brought to light many common issues and concerns faced by female engineering students. Pre/post course assessments of the targeted course outcomes showed a positive change in the students' knowledge, attitudes and habits, as related to professional development. Some of the strongest student-perceived changes over the course duration were focused around graduate program planning, the job search process, work-life balance, conflict resolution, and negotiation. Tangible outcomes included curriculum vitae, Gantt chart for progression through the graduate program, academic application packet materials, and outreach activities targeted to prospective and first-semester graduate students. The course was considered to be a success by the instructor and students, and can be used as a model for the implementation of similar courses within engineering departments or colleges.

Introduction

In 2006, total U.S. graduate school enrollment in engineering was 123,041 students with 27,944 (22.71%) female students[1]. A National Science Foundation (NSF) survey showed that the number of doctoral degrees earned annually by men in engineering fields almost tripled from 2,370 in 1978 to 6,164 in 2008. The number of doctoral degrees earned by women increased from 53 (2.2%) to 1,688 (21.5%) over the same time period, a 10-fold change over 30 years[2]. These numbers lag dramatically behind the life sciences where females earned 52.9% of doctoral degrees in 2008[3]. For chemical engineering, in 2006 there were 7,261 graduate students in 2006 of which 2,159 (29.73%)[1]. A slightly lower percentage of graduated female Ph.D. chemical engineers was recorded at 24.7% in 2008[3]. The influx of female graduate students into engineering fields is a very positive sign. However, the numbers of female engineers entering top-level academic and industrial positions have been sluggish to respond to the increasing numbers of female Ph.D. graduates. In 2006, 10.8% of tenured/tenure track faculty in engineering were women (0.7% in 1979) and female full professors were only 5%[4]. NSF published a report entitled "Gender Differences in the Careers of Academic Scientists and Engineers: A Literature Review" that concluded that the "body of literature we reviewed provides evidence that women in academic careers are disadvantaged compared with men in similar careers. Women faculty earn less, are promoted less frequently to senior academic ranks, and publish less frequently than their male counterparts"[5]. So, even women who earn Ph.D. degrees and obtain similar positions as men are not achieving pay, promotion, and career success

at the same levels as men. Mentoring and targeted professional development can provide significant support for female students allowing for more positive graduate program experience and higher matriculation rates, and result in these students having higher initial and continued success in industry, national labs, and academia.

Extensive data has been compiled on the progression of women into science and engineering careers as well as the efficacy of strategies to increase these numbers[6]. Mentoring is widely regarded as essential to positively impacting female success at all academic levels[7,8]. Many on-campus and electronic mentoring resources are available to provide a structured protégée-mentor pairing targeted to females and minority students from the undergraduate level up to graduate students to full professors in academia and highly ranked industry professionals[9,10]. While the structure and type of mentoring interactions vary widely, the mentor maintaining a sustained interest in the progress of the protégé has been identified as a key component of successful mentoring[8]. While one-on-one mentoring has been shown to have the greatest impact on the protégé, in an academic environment, the faculty member's availability may be limited and quality interactions may be infrequent. A formal professional development course, such as the one presented here, has the potential to impact and guide multiple graduate students at one time making the arrangement (from a faculty member's perspective) highly efficient and providing some additional benefits from additional perspectives and support network formed from the student-student interactions.

The Chemical Engineering (ChE) graduate program at Mississippi State University (MSU) has averaged a 27% female population over the past 9 years, close to the national average in graduate chemical engineering programs[1]. As a female faculty member, the instructor found the data to provide a compelling need to add a formal professional development course to the graduate curriculum of our women engineering students, as a means to strengthen their career commitment and success after completion of the Ph.D., form a community of support, and share common experiences and solutions that women engineers may encounter. Student professional development courses and programs are in place at schools around the nation, either as electives or required parts of the curriculum, but none exist within the Chemical Engineering department or the engineering college at MSU[9-13]. At MSU, a course entitled *Career Issues for Women in Engineering* was developed and taught in Spring 2009 to a group of female chemical engineering graduate students.

Several measures were taken to facilitate open discussion. These included a confidentiality policy, non-traditional classroom environment, outside venue, and promotion of open, non-judgmental dialogue; these are discussed in detail in the course structure section. The class met outside of the chemical engineering building in a non-traditional room that did not have rows of seats facing the instructor, but rather a small conference table. Adopting a more communal seating arrangement facilitated the sharing of information and opened communication by de-emphasizing the roles of instructor and student. This setting was informal and students felt very comfortable to be a part of the discussion. As a part of the course, the professor also invited some female faculty members to discuss their career path, work-life balance as an example, career development staff for assistance with preparing job application packets, job search and how to get maximum use of resources offered at MSU.

While many of the students in the class previously had isolated conversations regarding different aspects of graduate school with various faculty members, the students as a whole expressed a desire to have more structured sessions that would include the perspectives of other students, faculty members, and staff. The students were attracted to the course structure, as it provided an opportunity to devote time to discussing progression through the graduate program, professional challenges, and career planning while gaining insight from their peers and successful professionals. In addition, professional documents required for job application packages (industry and academic positions) were developed by the students, critiqued by the instructor (and in some cases their advisor), revised, and (re)reviewed by the instructor and fellow classmates.

The paper is organized into the following sections: course structure, course content, class outcomes, assessment, lessons learned, and conclusions. Each section provides details and discussion of different aspects of the course. This is accomplished through a dual perspective approach; the instructor's view of the topic is presented first, followed immediately by the students' perspectives. In order to clarify the paper organization, sections comprised entirely of student commentary are *italicized*. In addition to a quantitative summary of the pre/post course assessment, some open-ended responses from students have also been included.

Course Structure

Format: Presentation and Discussion

The *Career Issues for Women in Engineering* course was taught as a directed individual study (DIS) course, resulting in flexibility in the course structure and activities. This 1 credit hour course consisted of 1.5 hours per week in a group setting and 1.5 hours working on individual assignments. In addition to group discussions, the students were asked to participate in presentations, reading assignments, development and evaluation of professional documents, professional self-evaluations, and the development of a handbook and a workshop for prospective graduate students. Guest speakers from within the university were invited to the class to offer alternate perspectives and share their own career development insights. In general, most 'classes' consisted of a presentation-guided discussion on a pre-determined topic, led by the instructor, followed by discussions of related topics. The end of each class offered an opportunity for the students to ask any question and/or voice any comment or concern that was on their mind. There were no limitations placed on these 'end-of-class' discussions, and often no time limit as well. The flexible nature of the course allowed for extensive conversations on each topic presented in class. This allowed each student to voice her opinion, present a different perspective, or pose additional questions without being restricted to a set time for discussion. It was also very beneficial to be able to thoroughly discuss a multitude of topics without being limited by the title of the lecture. Often, the initial topic of discussion would reveal additional areas of interest that would then be added to the class topic schedule.

The instructor had an 'open door' policy inviting the students to meet outside of class. The students did openly discuss most of their issues, thoughts, and questions with the rest of the class, during the regular class time. In addition to in class discussions, two optional one-on-one feedback sessions were scheduled, one mid-semester and the other at the end of the semester.

Each student took advantage of these sessions to receive customized feedback on their personal and professional development, and also to discuss any topics that had impacted them specifically and were not suitable for group discussions. Open communication among class members was promoted through an early conversation regarding respectfulness. The students and the instructor agreed that during all conversations each individual would "maintain the highest standards of respect for the work and thoughts of themselves and others". Every action would "demonstrate respect for the learning process, yourself, your fellow researchers, and the instructor".

While this was a formal class with course meeting times, assignments, and the awarding of grades and course credit, the atmosphere made the class much different from a formal, lecture-style course. The informal style, enhanced by the course being conducted in a small conference room outside the chemical engineering building, set the tone for open, honest conversations. The structure and setting of the class made it very easy to speak frankly and openly about the issues that typical graduate students encounter. Instructor-lead presentations were effective and informative in providing basic background information as well as the instructor's views on each topic. Also, these presentations were provided to the students allowing them to be used as references later on should these issues be encountered during their careers. Following each presentation, an open discussion of the topic allowed for each of the students to express their individual thoughts and concerns, share a specific example, or to shift the focus to a related topic. Thus, the students were able to receive advice on how to handle potential situations in different ways that were tailored to their personalities, a particular work situation, or gather a hand-full of options that they could choose from the next time a similar issue was encountered. It was often that these end-of-class discussions produced the most immediately beneficial ideas and perspectives because they were focused around issues that the students had experienced or were currently experiencing.

Students' Perspective: This course facilitated communication with other graduate students and a realization that many other students had or were facing similar personal or professional issues. During the course, the graduate students were encouraged to be open in sharing problems they had previously faced or were currently facing and discussed different solution options. By limiting the class size, a comfortable environment was created that allowed for the relatively small group of graduate students to be open with students and faculty with whom they otherwise would not have conversed regarding issues with teaching, research, coursework, professors, research advisors, home life, etc.

The professor's 'open door' policy and self-evaluation meetings were also incredibly informative. The 'open door' policy, especially with a female professor, enabled the graduate students to inquire how the female professor might handle a difficult issue, both as a graduate student and as a professional, in 'real time'. The individual meetings with the instructor served to effectively provide time with a much-needed female mentor, an important aspect as the students now had a mentor that could offer advice and see their point of view as females, not just as engineers. The personalized feedback provided in these sessions was invaluable as it was often the first time any such evaluations were conducted with these students. Even when the student had previously had similar discussions with others, these feedback discussions with the instructor provided a much needed different perspective in an incredibly comfortable setting.

Each session also provided the opportunity to identify areas in need of improvement, highlight strengths, and develop personalized graduate program and personnel management plans.

Confidentiality

As agreed upon by the instructor and the students, the content of each class session and discussion were kept confidential. Each member of the class, including the instructor, signed a contract agreeing not to divulge the class content to anyone who was not a member of the class. The only exception was that the instructor-developed, written course materials could be shared. In fact, all students shared their new knowledge with colleagues, co-workers, and spouses at some point during the semester. The confidentiality agreement was used to promote openness and trust between the instructor and students, and among the students in the class. When guest presenters were invited to the class, an option of confidentiality was offered to them. All guest instructors chose to participate in the confidentiality agreement in order to help promote an open dialogue, and the students were informed of the guest's decision prior to the start of class. This was especially important for substantive discussion to take place with a new group member in such a short period of time. The confidentiality agreement was an integral aspect of the course as it allowed for thorough discussion on a variety of sensitive subjects. The agreement allowed students to feel confident that as long as what they said was respectful, there would be no repercussions for voicing their opinions.

Student's Perspective: In addition to the class agreement regarding respectfulness, the confidentiality agreement ensured open and honest conversation for the duration of the course. This agreement was easily the most crucial aspect of the course as it made open discussion work so well. Without this agreement, a large portion of the course conversations would not have occurred, reducing the impact of this class. Detailed issues or concerns impacting the graduate students' lives were discussed without worry for negative repercussions and without the awkwardness associated with posing each situation in a hypothetical context. While some students chose to discuss certain topics with their advisors, the confidentiality agreement aided in generating an open atmosphere and allowed for the discussion of topics that likely would not have been discussed otherwise.

Student Population

A pre-registration course description was emailed to all female Chemical Engineering graduate students at MSU, asking each student to evaluate their interest in this elective course. The female graduate Chemical Engineering population that semester consisted of 8 students (6 Ph.D. and 2 M.S.) and 5 of these students (4 Ph.D. and 1 M.S.) registered for the course. Three of the Ph.D. students were direct entry, while one had already completed a M.S. degree; the M.S. student is planning to pursue a Ph.D. at another university. All were from Chemical Engineering at MSU, but they represented a fairly diverse cross-section of the female graduate population in terms of age (23-32), marital status (80% of students married), nationality (1 international student), research area, and stage of their graduate program.

Student's Perspective: Students from three research groups within the Chemical Engineering department at MSU were represented in the course. While some of the students were highly

encouraged by their advisor(s) to enroll in the course, others received minimal input regarding their participation. Overall, the student population diversity in this class was immensely beneficial. The different experience levels and perspectives allowed for lively discussion and a wide range of issues and potential solutions. By sharing their experiences with one another, the students learned from each other's mistakes and triumphs not only as related to graduate school but also to their personal life. Essentially, the students within the class served as mentors to each other; students that were further along in the graduate program were able to advise the 'younger' students.

Course Content

The first day of class, the students were presented with a list of potential course objectives and topics (Table 1) and asked to rank their interest with low scores indicating higher interest levels. The topics with the lowest average interest score (Table 1) were given priority. In discussing the results of their interest surveys, the class also decided that teaching skills and project management were also topics that should be covered, if time allowed. This exercise of identifying and focusing the topics of discussion on what was rated highest by the graduate students allowed for the most efficient use of time and energy for all involved. Some of the discussion topics for this professional development course are discussed below.

Table 1. Student scored interest levels in proposed course objectives and topics.

Course Objectives:	**Average Score**
Outline and timeline for your progression through the *graduate program* with *dates*	2.8
Up-to-date resume/CV	3.4
Better understanding of networking strategies	3.6
Outline for your (proposed) path of progression through the *job search process*	3.8
Materials for an academic position application packet	3.8
Outline for your (proposed) path of progression through your *career*	4.8
Understanding of 'what is normal' in terms of professional workplace behavior	6.8
Strategies for handling disparaging comments	7.0
Course Topics:	**Average Score**
Work/personal life balance	2.0
Growth from a student to a professional (aka, skill development)	2.0
Career paths	3.6
Dual-career couples – job search, hiring process, and impact on work/life balance	5.6
Negotiating	6.4
Self-confidence and self-image	6.6
Conflict resolution	7.4
Gender issues in engineering graduate programs	8.0
Gender issues in engineering careers	8.4

“Things I Wish I’d Known” and ways to distribute this info to other students	8.8
Graduate committee membership	9.0
Ph.D. topic and relationship to career goals	10.2

Career Paths

Many students approaching graduation were undecided or noncommittal about their career path choices, even though it is perhaps the most important step in any students’ professional life. Several professional variables must be considered, e.g., interests (and specificity of Ph.D. research topic), position type (academia or industry), and pay scale. Often, personal likes and dislikes (e.g., location, weather, and distance from extended family) are also factors. Personal considerations that may or may not have been vocalized, but often must be considered include whether the student is married (or wants to be), has children (or wants to have children), or has family members in need of care available only in certain cities/regions. Career choices can quickly become much more difficult as the spouse’s professional opportunities (expanded upon in the dual career section), transportation availability, and educational, medical, and child care facilities become important factors in the job search, interview, and acceptance process.

In this course, most of the students were doctoral students with academia or industry paths available to them. The instructor presented some pros and cons of both career options, based on her experience with both academia and industry and shared experiences of her colleagues in both sectors. The instructor also brought in 3 other female engineering professors from MSU to discuss their experiences. In addition, a staff member from Career Services at MSU was brought in to specifically discuss the career search and interviewing processes. Resources were provided that described how to apply for doctoral-level positions, the do’s and don’ts of interviewing, etc. Some students wanted to consider working in a research area outside of their doctoral work after graduation; the instructor helped these students brainstorm opportunities to find common ground between their current and newfound interests, enhance their skill set, and network in the 'new' research area. The one-on-one individual meetings also provided a chance for students to discuss ideas, thoughts, and concerns regarding career paths with the instructor. An independent activity was given as an optional assignment to guide the students through identifying strengths, weaknesses, opportunities, and threats in themselves and their environment(s) as related to their career goals.

Work-Personal Life Balance

This phrase is often used in the context of a need to 'properly' prioritize career and family/leisure goals and time. The emphasis in the class by the instructor and the guest lecturers was an understanding that one set of priorities does not 'fit all'. Different options for maximizing effectiveness -- both at work and at home -- while minimizing 'busy work' were discussed. The need to define any required or desired boundaries between work and your personal life was also discussed, especially as related to personal relationships. Open discussion between family members, flexibility and periodically revisiting 'the rules' were offered as suggestions to prevent or mitigate discord regarding work schedules and/or locations. Tips/advice/effective solutions were offered by the instructor and her guest lecturers on making the best use of time (aka

multitasking), the need to sometimes focus on a narrow task, staying organized, and delegating. Stress, exercise, and proper health care were also discussed. One of the major topics discussed was the perception that can exist, either externally or internally within the female engineer herself, that she is somehow less committed or effective at her job if she has family, exercises, hobbies, etc. The timing of starting and/or expanding a family in context of your professional career was discussed on multiple occasions with the core class and also with each female engineer who guest lectured, many of whom had children / family commitments.

Dual-Careers

Three primary dual-career topics were discussed: job search, hiring process, and impact on work-personal life balance. Dual career couples are increasingly common nowadays, especially for women with engineering degrees[14-16]. There are many potential benefits for dual career couples including intellectual stimulation, enhanced understanding of career commitments, challenges, and goals, mutual, social and/or professional support structures, dual-gender role models for children, and increased financial stability[17]. Dual-career relationships do present some unique 'opportunities', but these can easily become 'difficulties' if not discussed openly, honestly and combined with compromises. Examples include whether one career takes precedent (and if so, then does that role change mid-career?), commute (one or both persons), long distance relationships (short- and long-term options), balancing household activities, simultaneous job searches or the lead-follow approach, etc. There may be a need to formally delineate between work and personal life, especially if the couple works for the same company/institution or in the same or closely related fields. Of the 5 students enrolled this course, 4 were members of dual-career couples and were already dealing with some of these issues as graduate students. Hints on how to apply for job positions, collect information from other experienced dual-career couples, and advance both careers collectively as a member of a dual-career couple were provided. An overriding theme through all discussions between the instructor, guest speakers, and the students was that communication was crucial when it comes to (almost) all aspects of life, but it is especially so when merging your career and life decisions with someone else.

Self-Confidence and Self-Image

Maintaining self-confidence and self-image is very important, but it is a topic that can be difficult to discuss openly. In general, most of the students had dealt with self-confidence issues to varying degrees. The instructor constructively helped to build self-confidence in all members of the class through group discussions as well as individually meeting with the students. During group discussions, the students discussed common problems they had faced. For example, most students may feel nervous and stressed when presenting in small and/or large group settings, taking oral examinations, and/or defending thesis and dissertations. The students in the class were no different, but also expressed feeling very unsure of themselves intellectually when questioned in the above situations and for significant periods of time after the presentation. The experience of losing self confidence after one of these situations was discussed, especially in the context of different approaches and behaviors, in general, exhibited by males and females and the growth expected in each of the students over the course of a graduate program and career. In addition, the instructor and students discussed realistic scenarios and solutions to tackle performance anxiety and self-confidence issues.

Self-confidence issues in undergraduate academic environments have been studied and self-efficacy is seen as a larger issue for women than for men[18-25]. Arms et. al found that females self-perceptions were lower than their actual ability[20]. For example, when entering college, 52.2% of women consider themselves to be "above average" or "highest 10%" compared to 68.8% of men in terms of academic ability. At this stage, women also indicate lower levels of math self-confidence even when their demonstrated mathematical ability is higher than that of their male colleagues[20]. During college, both men and women become less confident in their math abilities and for women, their confidence levels never return to their original value[26]. In fact, the majority of female students in science and engineering fields report a drop in self-confidence over the course of their first year in college[26]. However, succeeding in a math intensive field such as engineering has shown to increase self-confidence in women and their willingness to admit to their abilities. Women's interest in engineering stays more consistent over their four years of college (3.3% of women begin college majoring in engineering and 2.6% end college) whereas the same is not true for men (12.5% to 9.3%)[20].

The source of vulnerability in self-confidence may lie in social dynamics, meaning that women may feel more vulnerable towards negative comments about their performance than their male counterparts[21]. Further, females may consciously or subconsciously feel out of place in engineering settings because they remain a minority[21] and notice the lack of female role models (although this concern declines in importance from the first year to the senior year of college)[22]. Substantial data shows that engineering abilities are not necessarily the determining factor in student performance, in fact, the "research buttresses the call to engineering faculty to extend themselves to all students, because classroom discrimination or academic integration can either lower or raise student self-efficacy"[21].

Self-perception of ability has been shown to determine self-selection from engineering majors at the undergraduate level[23-25]. Those students who maintain a high level of self-confidence attribute it to enjoying their classes, considering competition to be a motivator, having friends who are in the same or similar fields, having supportive male friends and being involved in societies like Women In Engineering[26]. Declining self-confidence at the undergraduate level has been shown to lead to a change of major from science or engineering[23-25]. One premise of this professional development course was that this same trend may impact female graduate student performance and progression toward completion of their advanced degree.

Growth from a Student to a Professional

Growth from a student to a professional involves development of numerous skills including time management, verbal and written communication, facilitating discussions, networking, conflict resolution, personnel management, and leadership skills. Materials were presented in class and an open discussion at the end of the class aided each individual in identifying a current weakness and developing a plan to improve their relevant skill set. This course tried to teach the students how to look for opportunities to develop their skill sets, either through mentoring or through self-instruction. Meeting facilitation skills discussed included developing and using an agenda for meetings, organizing efficient meetings, assigning and utilizing action items, brainstorming, and tools like decision matrices and issue bin. Personnel management skills included scheduling,

time management, conflict resolution, and encouraging professional growth in your own researchers and staff. Communication was a major component of each of the skill development topics; suggestions related to improving listening, understanding and critiquing skills was provided through presentations. There were also discussions related to teaching in academia which covered topics such as how to engage students in a class, how to involve them in a discussion, learning styles of students, etc. The students found it to be very beneficial when the instructor shared her experiences in preparing the first lecture, structuring a course, and utilizing different teaching methods and active learning techniques.

Gender Issues in Engineering Graduate Programs and in Engineering Careers

Gender-related and gender-biased issues are commonly encountered in our society, but can be highlighted in a traditionally male field, such as engineering. In this course, the instructor provided guidance on tackling such issues and led a discussion with the students on gender-related or gender-biased issues they had faced professionally and personally. Some of the issues discussed included advisor-student relationships, family members' perception of an engineering career or career path, interactions between research group members, etc. This is one of the topics where students immediately applied some of the techniques discussed in class in their own situations in order to mitigate the negative environment created by gender-based conflicts and aggressive behaviors.

Other Topics

Class sessions were spent discussing the following topics:

- Negotiating
- Conflict Resolution
- Graduate Committee Membership
- Ph.D. Topic and Relationship to Career Goals
- "Things I Wish I'd Known" and Ways to Distribute this Info to Other Students
- Teaching Skills
- Project Management

The students found all of these topics to be informative and useful to their professional development, as is shown by the assessment results. However, due to brevity these topics will not be discussed here.

Students' Perspective: Since the class as a unit decided the discussion topics, the course content was very pertinent to each student's desired benefit. One of the most important topics covered was learning more about work/personal life balance. This topic allowed for the students to directly ask a person in their same profession about some techniques that might help them to have success in both aspects of their lives. Another topic of high value in the class was dual-career couples. The instructor and guest speakers provided management techniques that had been successful for each of them individually. The students found that these could easily translate to different relationships or scenarios in their own lives. Each guest speaker was invited during the course time to share their perspective on balancing work and personal life. Students were comfortable and able to share their thoughts and concerns, and valuable suggestions were offered by the instructor and the guests.

Another important aspect of this class was the conversations about and generation of a "Things I Wish I'd Known" list and discussion on ways to distribute this information to other students before entering/completing graduate school. Sharing the knowledge and experience with future or other current graduate students could have a positive impact on those students during their graduate career. Virtually every student during their academic career has thought, "I wish I had known this" at one point in time, so the students in this course along with the instructor compiled a list of important details that fall directly in the "Things I Wish I'd Known" category. These things might be minute details about the city they are planning to go to school or major details with course work, exams, etc. International students could also benefit by knowing the visa policies and regulations in U.S. universities, course work, credit requirements, maintaining full time status along with culture, language, and insurance requirements. Distribution of this information occurred through a 'manual' written by students of the DIS class, and will be provided to new students when they are offered acceptance into the graduate program in the chemical engineering department at MSU. The department currently has a standard manual given to all graduate students consisting of the typical requirements, rules and regulations, along with general graduate school policies, but lacks the practical information found in the DIS manual. The 'manual' assembled by the students of this class was intended to serve as a central source for the most common concerns faced by graduate students when they first arrive at MSU.

Other means of sharing this knowledge and experience were discussed, such as a presentation and panel discussion to provide information and guidance to current undergraduate students who are considering graduate school. Plans are in place to implement this panel session in Fall 2010. During the proposed panel discussion session, a diverse group of invited panelists will present general and department-specific information and then answer questions from the audience. The panelists may consist of faculty and students from the chemical engineering department and staff from the graduate school and/or college. Presented topics could range from why to attend graduate school, the standardized tests required for admission, the admission process, what to expect (and not expect) in graduate school, how to choose their research area and advisor, assistantship and fellowship opportunities, appropriate graduation time frames, career path after graduation, and financial incentives from completion of a graduate degree. After the presentation, the floor will be opened for discussion allowing prospective graduate students the opportunity to have any questions or concerns addressed. Once the open discussion concludes, the faculty and staff panelists would be asked to leave the room so that the graduate student panelists would be available to prospective students for continued conversation and refreshments. This second period is aimed at allowing the prospective students to ask questions of current graduate students.

The remainder of the topics covered in this class were just as valuable, and will be utilized both as the graduate students finish their degree programs and in the future as professionals. One special aspect to this class was the discussion about how our personal lives do and will continue to affect our professional decisions. The material and the manner in which it was communicated will definitely help ease the transition from student to professional.

Outcomes

Tangible outcomes for this course were to develop (or update) their resume/CV, a timeline and Gantt chart for their planned progression through the graduate program, personal and professional goal setting for the next 3-12 months, outline and timeline for the job search process, proposed career path, and academic and industry position application materials. These documents were scheduled as weekly or biweekly assignments. The assignments were reviewed multiple times during the semester by the instructor and individualized feedback was provided based upon the students' background and planned career path. Some of the job application packet documents were also peer reviewed, so that the student was aware of different styles of writing or points of emphasis. The students then discussed these documents, especially the research and graduation timeline and Gantt chart, with their research advisor. The timelines and Gantt charts proved to be very useful for the student to track their own progress and stay 'on track'; these tools also provided them with feedback as to whether they were being effective at their own time management, task prioritization, and personnel management (undergraduate researchers, primarily) tasks.

In terms of 'soft' outcomes, the students were able to develop skills in communicating in a group environment, recognizing unacceptable workplace behaviors and developing strategies for handling these situations, and overcoming public speaking and networking fears. Students could meet the instructor individually if they were not comfortable in sharing issues in the class; thus, a wide-range of topics could be discussed and at different levels of sharing. The semester-long course allowed students the opportunity to actually try out the multiple suggestions given by the instructor to any concern and report back on their success or failure – to the instructor and/or the group.

Students' Perspective: Generating an outcomes list at the beginning of the course was a very useful activity. Since the class as a whole reviewed and agreed on the outcomes, it ensured each student would be fully engaged and benefit from completing each item on the list. Intermediate and final deadlines the instructor assigned forced us to take time to think about our careers, in terms of current activities, graduate program, employment, and document expectations and goals. The outline for the graduate program completion was particularly helpful in assisting each student to think about and propose a task schedule, discuss this draft task list and schedule with their advisors, revise the outline, and receive advisor approval with regard to a tentative path and timeline for the completion of their degree. The documents generated as part of the outcomes for this class (e.g., CV/resume, timeline and Gantt chart for graduate program progression, timeline for job search process) required each student to develop and openly disclose their plan for finishing thesis/dissertation work, starting career planning, and defining career goals.

Assessment

The five female students enrolled in the professional development course were asked the same series of 23 questions to assess their attitudes and habits at two points in time: 1) prior to entering the course and 2) upon exiting the course. The complete survey is provided in Appendix A and B. Individual responses were recorded and the same questions paired between pre and post

surveys; group trends were then compiled. Responses for questions 2 through 23 were all cast on a 5-point Likert scale with 5 being the highest rating, 3 as neutral and 1 as the lowest rating. Question 1 was on a 4-point scale because the responses were linked to timeframes (4 = every month, 3 = every 2-4 months, 2 = once per year, and 1 = don't have resume/CV).

Figure 1 shows the average student responses by question. Averages of the students' pre-course responses are provided in blue (shorter columns) with post course responses given in red (taller columns). Responses at the beginning of the course ranged around 3, which is a neutral rating on the Likert scale provided. However, at the completion of the course, student responses were all above 4 with some responses (questions 3, 10, 18, 21) yielding a unanimous 5 rating. This indicates the students were positive and had a written list of professional goals, knew academic/industry application packet components, were familiar with gender issues in engineering careers, and had familiarity with conflict resolution techniques. This trend can be observed also when examining overall the question-by-question differences in the post- and pre-course responses (Table 2). The student's average change from pre- to post-course responses was uniformly positive toward a higher rating on the Likert scale. Individual students ranged from differences of 0.9 to 2.4 when averaging across all questions. A change of ~1 is equivalent to a full move up from neutral (3) to good (4). A change of 2.4 is a move up from just below neutral (<3) to the highest rating possible (5). Overall, students' ratings of their attitudes and habits increased almost 2 full points.

In the post-course survey, students were asked to rank course outcomes as well as course topics as most important (score of 1) to least important (score of 9). Knowing that this could disguise how important the students felt each topic was, they were concurrently asked to rate how beneficial each course outcome and course topic. The rating used was 5 = Extremely Beneficial, 4 = Beneficial, 3 = Neutral, 2 = Detrimental, and 1 = Extremely Detrimental. These results are broken apart into separate tables below with Table 3 summarizing Course Outcomes and Table 4 summarizing Course Topics. Both tables are organized with the overall ranking listed in the left column and the corresponding rating of importance in the right column for each subject. The top ranked course outcomes were the tangible guidance on progress through the graduate program, followed closely by documentation of professional accomplishments with a well-composed and updated curriculum vitae. The final report was ranked 9th by all but one respondent. However, it should be noted that all ratings are greater than neutral and were classified as beneficial to a varying degree.

As shown in Table 4, the course topics were assessed in a similar fashion with both a rank ordering of topics from most useful to least useful in the left column followed by a rating of each topic's importance according to the key above in the right column. Those items ranked as most useful were related to managing professional and personal growth. Gender issues were ranked lower. The ratings of importance do not track the rankings precisely, but still demonstrate that the students viewed all topics as beneficial.

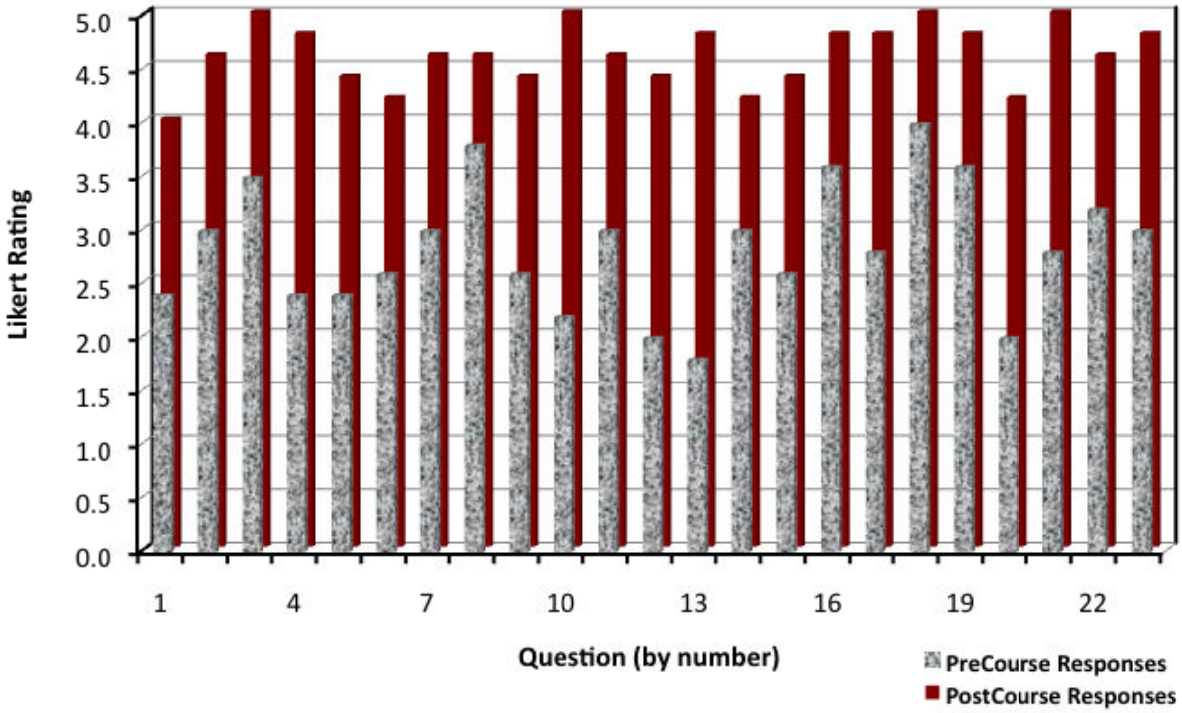

Figure 1: Average student Likert ratings for identical pre- (pixeled, grey shorter columns) and post-course (red taller columns) assessment questions (available in Appendix A). For every assessment question, the student rating increased significantly after the course completion.

Table 2: Average differences tabulated by question between the post- and pre-course responses.

	Question	Average Difference
1	Updated resume / CV	1.6
2	List of personal goals	1.6
3	List of professional goals	1.6
4	Outline & timeline for graduate program	2.4
5	Outline & path for job search	2
6	Outline & path for career	1.6
7	Dealt with disparaging comments productively	1.6
8	Dealt well with unprofessional workplace behavior	0.8
9	Adept at networking	1.8
10	Knew materials to develop for academic application packet	2.8
11	Familiar with possible career paths	1.6
12	Attained a healthy work / personal life balance	2.4
13	Approach to dual career job searches, hiring, work / life balance	3
14	Rate my self-confidence	1.2
15	Knew how to grow from student to professional	1.8
16	Impression of gender issues in engineering graduate programs	1.2
17	Impression of how to handle gender issues in eng. graduate programs	2

18	Impression of gender issues in engineering careers	1
19	Impression of how to handle gender issues in engineering careers	1.2
20	Experience with negotiating and negotiation strategies	2.2
21	Familiarity with conflict resolution techniques	2.2
22	Selection of graduate committee and mentoring value	1.4
23	Selection of Ph.D. topic and advisor based on career goals	1.8
	Average change over all questions	**+1.77**

Table 3: Average student-determined rank order and rating of course outcomes.

COURSE OUTCOMES: Post-Course Rank of Most Useful to Least Useful		**Rating of Value**
1	outline and timeline for progression through the graduate program	5
2	up-to-date resume/CV	4.8
3	materials for an academic position application packet	4.6
4	outline for (proposed) path of progression through the job search process	4.2
5	understanding of 'what is normal' in terms of professional workplace behavior	4.2
6	strategies for handling disparaging comments	4.6
7	better understanding of networking strategies	4.2
8	outline for (proposed) path of progression through career	3.8
9	final written report outlining the outcomes of the class	4

Table 4: Average student-determined rank order and rating of course topics.

POST-Course Rank of Most Useful to Least Useful Course Topics		**Rating of Value**
1	Work/personal life balance	5
2	Career paths	4.4
3	Self-confidence and self-image	4.8
4	Dual-career couples – job search, hiring process, and impact on work/life balance	4.4
5	Growth from a student to a professional (aka, skill development)	4.8
6	Conflict resolution	4.6
7	Negotiating	4.4
8	Graduate committee membership	3.6
9	"Things I Wish I'd Known" and ways to distribute this info to other students	4.4
10	Gender issues in engineering graduate programs	4.2
11	Ph.D. topic and relationship to career goals	4
12	Gender issues in engineering careers	4

Open comments were welcomed in the pre-course survey with the question, "24. Why did you enroll in this DIS course and what did you hope to gain from it?" Responses were:

* *Develop professionally, learn teaching skills, gain self-confidence, preparing application packet for academic job, plan career path.*
* *I enrolled in the course to learn the skills that would help me through the rest of graduate school and my career, and to hear from the others involved in the class as to deal with unpleasant situations.*
* *I had no knowledge about how to move forward in terms of my career. I hoped to gain the tools necessary to be successful in the future.*
* *To learn how to balance life, work and transition from grad school to professional life.*
* *To gain knowledge about transitioning from student to professional. I signed up for the class to assist in helping me make my goals concrete for finishing graduate school. I was also looking for a mentor to help guide/refine my career goals and a path to achieve those goals along with balancing career with children.*

Feedback was solicited in the post-course survey with questions, "26. What was the most valuable thing you learned in this course and why?"

* *Teaching skills / job application process*
* *I learned that no matter how strong and together someone appears to be, everyone has moments of doubts and insecurity. This was extremely helpful in my own moments of doubt.*
* *How to approach the job application.*
* *Increasing my self-confidence. It impacts every aspect of your life.*
* *I learned how to have a career and a family. This was most valuable to me because I want to be a great mom and very successful in my chosen career.*

The final post-course question was, "29. Are there course topics or outcomes that were not included that you think would be useful to you either as a graduate student or in your future career?" Feedback varied and included:

* *More teaching skills and how to prepare the first lecture. Improve public speaking skills.*
* *I can't think of any in particular. More time spent on the self-confidence topic may have been helpful.*
* *A discussion on ethics (applied to employment and within the school setting) would be useful.*

Lastly, the students were asked to rate the instructor using a standard faculty evaluation for lecture classes. The responses were solicited again on a 5-point Likert scale and were overwhelmingly scored in the strongly agree column for all categories. Future assessments are planned at the students' graduation and 5 years post-graduation. At graduation, the students will be asked to provide information on their graduation date, number and type of publications and presentations to date, job search strategy and successes, and perspectives on the course. At 5-years post-graduation, the students will be contacted and asked to update their career position details, number and type of publications and presentations (if applicable), and perspectives on the course. This 'at graduation' and '5-years post-graduation' information will be compared to the data collected in course assignments, and will include the students' self-described graduation date, publication and presentation type and number to date, publication goals, and career path expectations.

Lessons Learned

This one credit hour course took a substantial time commitment from the faculty member, comparable to the preparation of a new 3 credit hour technical course. For each class, the presentation materials needed to be developed and resources gathered for distribution prior to class (when possible) to enable the students to review. This was done to allow the in-person meetings to operate more efficiently and give ample time for discussion rather than lecture. Despite this measure, this course never/rarely ended on time. Discussions superseded time allowances and a time keeper was eventually volunteered to limit the time for discussion. Although this was necessary out of practicality, it did hamper the discussions. In this course the novelty and excitement, for both the instructor and the students, was notable. One technique that will be utilized the next time this course is taught is the concept of the issue bin. Students and faculty have a lot of issues and ideas to share and although a schedule of topics was developed at the outset of the course, it was very easy for the open discussion period at the end of the class to digress away from the 'topic of the day'. An issue bin would allow for these topics to be mentioned – while they are fresh in the minds of the students – but reserved until a class period that most closely match the topic. In addition, the structure of this course allowed for individual meetings between the students and the faculty member and a lot of document review and editing (e.g., CV/resume, teaching philosophy, research plan). These were very valuable aspects of the class and the authors do not recommend their elimination in order to reduce the instructor's time commitment. A round-robin approach was utilized to allow the students to critique one another's documents prior to the faculty member reviewing them in order to reduce grammatical and formatting edits.

In hindsight, this course attempted to 'do too much'. No general professional development course exists for the graduate students in the chemical engineering department, or the engineering college, at MSU. The addition of an arena for topics to be covered that are gender neutral (e.g., CV/resume development, career planning, job search strategies, Gantt chart) would free time for the students and faculty to focus on gender-specific professional development course topics.

This course strategy could not be easily converted to a large group setting. There is a level of intimacy that is needed for many students to openly discuss their fears, failings, and hopes. However, a model for implementing this course in large departments and even at the college or university level is presented – and is the tentative model for future offerings of this course at MSU. For an institution without a formal professional development curriculum, it is suggested that professional development activities be incorporated into a for-credit course, such as seminar or directed individual study. As part of a course, the students would receive guidance on some or all of the outcomes from this course (Table 3) and a mechanism would be in place (grades) for the students to follow through with drafting and receiving concrete feedback on their documents. A second credit hour/course would allow students and faculty (perhaps of both genders) who had an interest in STEM career issues (as related to perhaps to gender, marital status, and family composition) to participate in small group discussions, with each group registered for a different section. If this professional development course were team taught, then the burden of carrying out the general sessions would be divided amongst several faculty and then each of these faculty would be responsible for one discussion section. At the mid-point and end of the semester, all of

the students and faculty from the discussion sections could meet to exchange ideas and questions. Outlined above is just one implementation model for a professional development course targeted to women; a great many variations could be envisioned.

Student's Perspective: The lessons learned and tangibles obtained during this course as related to professional development were phenomenal. These included developing a curriculum vitae, searching for academic or industrial jobs, interviewing for advanced degree positions, negotiating, and networking which helped many students in the process of applying for positions. Time management techniques were very useful and helped students learn to prioritize tasks based on the need and goal of completing their graduate program. Of specific use, the four quadrant system for time management was taught by the instructor, implemented by many students, and was followed up on after a few weeks to see the progress. In addition to time management skills, conflict resolution techniques were also learned; even graduate students can benefit from learning how to work well with others and resolve any conflicts that may arise as conflicts occur in any aspect of life whether career or personal, effective handling of these conflicts is necessary to maintain good atmosphere. Each topic discussed in this class had immediate implications for completing our graduate programs, but also provided a new skill set that will be utilized in our future careers.

On a personal level, much was learned on finding balance between career and family, managing a dual-career household, and enhancing self-confidence. The fact that nearly everyone involved with the course at some point shared feelings of frustration and self doubt was an unexpected and somewhat welcome revelation. These personal lessons can be utilized at many levels to assist in achieving success in life as well as in a career.

As students, it was encouraging to know that while several female faculty members had experienced challenging situations similar to our own, they were able to grow, advance, and manage a successful career. The class discussed specific issues and experiences and how graduate students had (or might) handle them. For each scenario, the professor discussed the pros/cons of various actions, provided suggestions for reasonable solutions, and followed up on the outcomes if the students chose to address that particular situation during the course duration. An important lesson learned from class discussions was how to communicate effectively with the student's major professor and graduate committee, allowing the students to feel better connected to their advisor and their research project. Many students found that their advisor was supportive of the professional development activities and showed a willingness to engage in related discussions; this secondary discussions enabled the student to feel that both they and their advisor had a mutual understanding of graduate program expectations and goals, and created opportunities to more openly discuss work/life balance and post-graduation plans. It was found that an advisor's support in taking this class translated to more discussion in general and was perceived as helping to avoid or correct miscommunications that can often occur.

An unexpected outcome of this class was the strong peer support network that developed as the students progressed further in the class. Having open discussions, that the confidentiality agreement permitted, allowed the students to become a support system for one another. This

type of professional support network is integral for success in graduate school because there will always be someone else to talk to who may have been through a similar situation.

Conclusions

The initial offering of this professional development course involved a very small and diverse group of female graduate students from the chemical engineering department at MSU so that the students could obtain maximum benefit. In a larger group of students, this class would not have been as effective since with a larger group many students would not participate in open discussions, time constraints would further limit discussions, and it would be difficult for the instructor to give individual attention and mentoring to each student. However, a model has been provided to implement this course in a large student population.

This class provided information, resources, and guidance to students on professional development in the context of being a female engineer. Some of the main topics discussed were choosing and planning a career path, personnel and project management, conflict resolution, work-life balance, negotiating, networking, and improving self-confidence and self image. Moreover, the class offered mental relief as the topics were interesting and relevant to all the participants, and the material, course structure, and environment were atypical of traditional classes. These aspects of the class, in addition to the confidentiality agreement, were vital to the open sharing of information. Students were allowed to assist in selecting the course content, which provided student ownership in the course. Tangible outputs of the class included a resume/CV, graduate program Gantt chart, and academic position application materials. Guest speakers offered different perspectives on several relevant topics, giving students a range of experiences from which to draw upon. Discussion and examples of many different paths all leading to successful engineering careers was extremely helpful is dispelling the myth that there is one 'right' career, career path, timeline, etc. Sometimes female engineers find themselves as the 'first' or 'only' female in a particular group, and the students were relieved to learn about how their career can be customized to them and their particular skills, interests, and situation. One-on-one meetings with the instructor gave students a chance to speak directly and sometimes more openly with the instructor about any concerns they had. These meetings were also used to perform SWOT analyses and receive personalized feedback. Every class had a focused presentation and discussion that helped to build a knowledge base and prepare the students to handle current and future professional challenges with confidence. The keys for success in this type of course are open, two-way communication, multiple perspectives (external speakers), a mixture of small group and one-on-one interactions, and follow-up discussions after the course.

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Appendix A: Pre-course Survey

On a 5-point Lickert scale, rate how much you agree with the following statements:

1. Prior to entering this course, I updated my resume / CV
   a) Every month
   b) Every 2-4 months
   c) Once per year
   d) I didn't have a resume / CV

2. Prior to entering this course, I had a well-defined list of personal goals for the next 3 to 5 years.
   a) Strongly agree, these were written down and I had discussed them with my mentor(s).
   b) Agree, I had written them down but not discussed them with anyone.
   c) Neutral, I had thought about it, but didn't have anything concrete.
   d) Disagree, I had only fleetingly thought about it.
   e) Strongly disagree, I didn't worry about tomorrow at all.

3. Prior to entering this course, I had a well-defined list of professional goals for the next 3 to 5 years.
   a) Strongly agree, these were written down and I had discussed them with my mentor(s).
   b) Agree, I had written them down but not discussed them with anyone.
   c) Neutral, I had thought about wanting a degree but that is it.
   d) Disagree, I had only fleetingly thought about it.
   e) Strongly disagree, I didn't worry about tomorrow at all.

4. Prior to entering this course, I had developed an outline and timeline for my progression through the *graduate program* which included *dates*
   a) Strongly agree, these were written down and I had discussed them with my mentor(s).
   b) Agree, I had written them down but not discussed them with anyone.
   c) Neutral, I had thought about wanting a degree but that is it.
   d) Disagree, I had only fleetingly thought about it.
   e) Strongly disagree, I didn't worry about tomorrow at all.

5. Prior to entering this course, I had developed an outline for my (proposed) path of progression through the *job search process*
   a) Strongly agree, these were written down and I had discussed them with my mentor(s).
   b) Agree, I had written them down but not discussed them with anyone.
   c) Neutral, I had thought about wanting a job but that is it.
   d) Disagree, I had only fleetingly thought about it.
   e) Strongly disagree, I didn't worry about tomorrow at all.

6. Prior to entering this course, I had developed an outline for my (proposed) path of progression through my *career*
   a) Strongly agree, these were written down and I had discussed them with my mentor(s).
   b) Agree, I had written them down but not discussed them with anyone.
   c) Neutral, I had thought about wanting a 'good career' but that is it.
   d) Disagree, I had only fleetingly thought about it.
   e) Strongly disagree, I didn't worry about tomorrow at all.

7. Prior to entering this course, I had dealt with disparaging comments in a healthy and productive fashion.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

8. Prior to entering this course, I had dealt with situations that were uncomfortable in terms of professional workplace behavior
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

9. Prior to entering this course, I was adept at networking on campus, regionally, and nationally at conferences / other professional events.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

10. Prior to entering this course, I knew what material to develop and include in an academic position application packet
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

11. Prior to entering this course, I was very familiar with all possible career paths my degree would open up for me.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

12. Prior to entering this course, I felt I had attained a healthy work / personal life balance.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

13. Prior to entering this course, I knew how to approach dual-career couple job searches, the hiring process, and work/life balance.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

14. Upon entering this course, I would rate my self-confidence as….
   a) Excellent – I could do anything
   b) Good – I believed in myself most of the time
   c) Neutral – I was surviving
   d) Fair – I believed in myself some of the time
   e) Poor – I want to give up and hide in a box

15. Prior to entering this course, I knew what I needed to do to grow from a student to a professional in chemical engineering.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

16. Prior to entering this course, I thought gender issues in engineering graduate programs were
    a) Very prominent and impacted graduation / success rates
    b) Existed but did not impact graduation / success rates
    c) Neutral – didn't pay attention at all
    d) Rarely existed
    e) Did not exist at all

17. Prior to entering this course, I thought gender issues in engineering graduate programs were to be addressed
    a) Very directly
    b) Handled discretely
    c) Neutral
    d) Talked about behind closed doors
    e) Ignored completely

18. Prior to entering this course, I thought gender issues in engineering careers were
    a) Very prominent and impacted graduation / success rates
    b) Existed but did not impact graduation / success rates
    c) Neutral – didn't pay attention at all
    d) Rarely existed
    e) Did not exist at all

19. Prior to entering this course, I thought gender issues in engineering careers were to be addressed
    a) Very directly
    b) Handled discretely
    c) Neutral
    d) Talked about behind closed doors
    e) Ignored completely

20. Prior to entering this course, I had experience negotiating or was familiar with how to negotiate successfully.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

21. Prior to entering this course, I was familiar with conflict resolution techniques.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

22. Prior to entering this course, I knew who should be on my graduate committee and why these individuals were excellent mentors for my professional development.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

23. Prior to entering this course, I knew which Ph.D. topic / advisor I should [have] pursue[d] because I knew how they related to my career goals.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

24. Why did you enroll in this DIS course and what did you hope to gain from it?

Appendix B: Post-course Survey:

On a 5-point Lickert scale, rate how much you agree with the following statements:

1. After this course, I plan to update my resume / CV
   a) Every month
   b) Every 2-4 months
   c) Once per year
   d) I don't have a resume / CV

2. After this course, I have a well-defined list of personal goals for the next 3 to 5 years.
   a) Strongly agree, these are written down and I have discussed them with my mentor(s).
   b) Agree, I have written them down but not discussed them with anyone.
   c) Neutral, I have thought about it, but don't have anything concrete.
   d) Disagree, I have only fleetingly thought about it.
   e) Strongly disagree, I don't worry about tomorrow at all.

3. After this course, I have a well-defined list of professional goals for the next 3 to 5 years.
   a) Strongly agree, these are written down and I have discussed them with my mentor(s).
   b) Agree, I have written them down but not discussed them with anyone.
   c) Neutral, I have thought about wanting a degree but that is it.
   d) Disagree, I have had only fleetingly thoughts about it.
   e) Strongly disagree, I don't worry about tomorrow at all.

4. From this course, I have developed an outline and timeline for my progression through the *graduate program* which includes *dates*
   a) Strongly agree, these are written down and I have discussed them with my mentor(s).
   b) Agree, I have written them down but not discussed them with anyone.
   c) Neutral, I have thought about wanting a degree but that is it.
   d) Disagree, I have only had fleetingly thoughts about it.
   e) Strongly disagree, I don't worry about tomorrow at all.

5. After this course, I have developed an outline for my (proposed) path of progression through the *job search process*
   a) Strongly agree, these are written down and I have discussed them with my mentor(s).
   b) Agree, I have written them down but not discussed them with anyone.
   c) Neutral, I have thought about wanting a job but that is it.
   d) Disagree, I have only fleetingly thoughts about it.
   e) Strongly disagree, I don't worry about tomorrow at all.

6. From this course, I have developed an outline for my (proposed) path of progression through my *career*
   a) Strongly agree, these are written down and I have discussed them with my mentor(s).
   b) Agree, I have written them down but not discussed them with anyone.
   c) Neutral, I have thought about wanting a 'good career' but that is it.
   d) Disagree, I have only fleetingly thought about it.
   e) Strongly disagree, I don't worry about tomorrow at all.

7. As a result of this course, I have dealt with disparaging comments in a healthy and productive fashion.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

8. As a result of this course, I have dealt with situations that were uncomfortable in terms of professional workplace behavior
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

9. As a result of this course, I am adept at networking on campus, regionally, and nationally at conferences / other professional events.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

10. As a result of this course, I know what material to develop and include in an academic position application packet
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

11. As a result of this course, I am very familiar with all possible career paths my degree would open up for me.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

12. As a result of this course, I feel I have attained a healthy work / personal life balance.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

13. As a result of this course, I know how to approach dual-career couple job searches, the hiring process, and work/life balance.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

14. Upon exiting this course, I would rate my self-confidence as….
   a) Excellent – I could do anything
   b) Good – I believed in myself most of the time
   c) Neutral – I was surviving
   d) Fair – I believed in myself some of the time
   e) Poor – I want to give up and hide in a box

15. Exiting this course, I know what I need to do to grow from a student to a professional in chemical engineering.
   a) Strongly agree
   b) Agree
   c) Neutral
   d) Disagree
   e) Strongly disagree

16. After this course, I think gender issues in engineering graduate programs are
   a) Very prominent and impacted graduation / success rates
   b) Existed but did not impact graduation / success rates
   c) Neutral – didn't pay attention at all
   d) Rarely existed

e) Did not exist at all

17. After this course, I think gender issues in engineering graduate programs are to be addressed
    a) Very directly
    b) Handled discretely
    c) Neutral
    d) Talked about behind closed doors
    e) Ignored completely

18. After this course, I think gender issues in engineering careers are
    a) Very prominent and impacted graduation / success rates
    b) Existed but did not impact graduation / success rates
    c) Neutral – didn't pay attention at all
    d) Rarely existed
    e) Did not exist at all

19. After this course, I think gender issues in engineering careers are to be addressed
    a) Very directly
    b) Handled discretely
    c) Neutral
    d) Talked about behind closed doors
    e) Ignored completely

20. After this course, I have experience negotiating or am familiar with how to negotiate successfully.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

21. After this course, I am familiar with conflict resolution techniques.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

22. After this course, I know who should be on my graduate committee and why these individuals would be excellent mentors for my professional development.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

23. After this course, I know which Ph.D. topic / advisor I should [have] pursue[d] because I know how they relate to my career goals.
    a) Strongly agree
    b) Agree
    c) Neutral
    d) Disagree
    e) Strongly disagree

24. In the left column, please rank order (from 1 to 9) the course outcomes from most useful down to least useful to you. In the right column, provide a score according to the following rubric:
    a) Extremely beneficial
    b) Beneficial
    c) Neutral
    d) Detrimental
    e) Extremely detrimental

RANK (1-9)		SCORE (a-e)
	up-to-date resume/CV	
	outline and timeline for progression through the graduate program	
	outline for (proposed) path of progression through the job search process	
	outline for (proposed) path of progression through career	
	strategies for handling disparaging comments	
	understanding of 'what is normal' in terms of professional workplace behavior	
	better understanding of networking strategies	
	materials for an academic position application packet	
	final written report(s) outlining the outcomes of the class	

25. Were there other course outcomes that you feel were useful to you? If so, describe and provide with a score (a-e).

26. What was the most valuable thing you learned in this course and why?

27. In the left column, please rank order (from 1 to 12) the course topics from most useful down to least useful to you. On the right column, provide a score according to the following rubric:
    a) Extremely beneficial
    b) Beneficial
    c) Neutral
    d) Detrimental
    e) Extremely detrimental

RANK (1-12)		SCORE (a-e)
	Career paths	
	Work/personal life balance	
	Dual-career couples – job search, hiring process, and impact on work/life balance	
	Self-confidence and self-image	
	Growth from a student to a professional (aka, skill development)	
	Gender issues in engineering graduate programs	
	Gender issues in engineering careers	
	Negotiating	
	Conflict resolution	
	Graduate committee membership	
	Ph.D. topic and relationship to career goals	
	"Things I Wish I'd Known" and ways to distribute this info to other students	

28. Were there other course topics that you feel were useful to you? If so, describe and provide with a score (a-e).

29. Are there course topics or outcomes that were not included that you think would be useful to you either as a graduate student or in your future career?