

# CAREER STRATEGIES FOR ENGINEERING WOMEN: An industry-designed class aiming to increase success and retention in the engineering workforce

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*Index Terms* — Career Development, Industry Partnership, real world tools, retention

**Abstract** — This paper describes a career development class created through a joint effort of the Penn State Women in Engineering Program and Dean's Corporate Advisory Board. The course is designed to prepare women for success and retention in industry and is team taught by industry representatives. The course focuses on introducing tools, folkways and methodologies and is unique in implementing industry tools in the class, particularly the 360° assessment tool as the final grading mechanism. Early assessment of the course indicates that it is successful in meeting its objectives.

## INTRODUCTION

Creating a continuum of development and leadership that prepares women engineering students to bridge the gap between graduation and the realities of the workplace is a critical need.<sup>4</sup> Many activities of targeted programs for women and minorities focus on retaining them in the engineering curriculum rather than developing them for success in the curriculum and in their careers. This course aims to do the latter and builds on important continuing efforts undertaken by Universities and organizations by adding asynchronous communication with industry and the active integration of tools that students will use in industry. An example of this is using 360° assessment as the final grading tool.

To meet this need, the Penn State Women in Engineering Program Dean's Advisory Board developed a syllabus for the Career Strategies for Engineering Women course, piloted in Fall 2003. (There is more discussion on the process in Course Development below).

The class became the cornerstone of the Penn State Women in Engineering Program (WEP) Career Development and Leadership Initiative, designed to implement industry methodologies in the classroom to introduce junior and senior engineering women to industry career tools for planning and career development; career assessment practices; gender and diversity issues in the workplace; what industry managers and executives are reading; and current industry communication practices. Industry engineers and managers participated as content presenters, evaluators and mentors. Use of ANGEL, an

interactive web-based course management tool, allowed continuous, asynchronous involvement and interaction among students and faculty. The initiative comprises:

- A cornerstone upper level career development course based upon recommendations by the WEP Corporate Advisory Board
- Active involvement by industry professionals as instructors, co-developers of modules, case studies and projects
- Workshops beginning in the first year of the undergraduate curriculum and continuing throughout that introduce and reinforce leadership, planning and career development
- Creation of a mentorship program for upper level engineering women that focuses on career planning and involves industry mentors

The course and initiative have the goal of helping engineering graduates bridge the gap between academic studies and the demands and expectations of the workplace. The Career Strategies course focuses on developing performance, planning and other professional workplace skills as a way to introduce women students to their options in the workplace, to how they can prepare for success after graduation, and a familiarity with the tools by which they will be judged.

Objectives are:

- To better prepare undergraduate engineering women for a successful transition to the engineering workplace
- To provide a platform from which women can begin to develop the understanding, knowledge and skills necessary for post graduation success
- To provide active and visible women and men engineers as role models and mentors
- To actively engage future employers in career development activities

Ultimately it is anticipated that the developed course will be made available to all engineering students, while still offering all-women sections. One of the problems of a potential scale up is maintaining the value of the gender components and the open discourse around those issues in the class. As with many initiatives for women in engineering, this class would benefit any engineering student.

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## **COURSE DESCRIPTION**

The Career Strategies for Engineering Women course was piloted in Fall 2003 as a three-credit, upper level course and is scheduled for Fall 2004. The course is a 400 level, 3 credit course that counts towards the Penn State Engineering Leadership Development and Entrepreneurship Minors and the technical elective requirement in some majors.

This foundational course focuses on developing planning, performance and workplace skills and knowledge and developing familiarity with the actual management and career tools used in industry as a way to prepare women students for career challenges and success. The course is based upon the premise that we need to go beyond the point where women are coached and primed primarily to succeed in an academic curriculum; we need to create an awareness of the skills and attitude needed for success beyond graduation in the workplace and a place to begin to acquire them. The course emphasizes why a range of skills is necessary and how those skills can be attained.

The course incorporates oral and written presentations and assignments, industry mentors, journal entries and team projects. The syllabus covers: Critical Thinking, Problem Solving, Strategy; Project and Time Management; Effective Execution and Accountability; Career Planning; Performance Assessment; Communication Skills and Organizational Structure; Methodologies and Standards; Diversity; Ethics; and Financial Planning.

Seventeen guest instructors from twelve different companies participated as guest presenters and course mentors. While most of the instructors participated in person, several met with the class via teleconferences and video conferencing. This was a deliberate part of the course, designed to make students familiar and comfortable with typical meeting methodologies in industry.

Twelve women took the pilot course. Students were required to do two semester long projects relevant to the course subject matter and under the supervision of an industry mentor. WEP worked with industry partners to develop class projects and case studies as well as the semester long team projects.

A core activity of the course was assessment as performed in industry. Students and their corporate mentors undertook a semester long 360° assessment that determined their final course grade. This is a process by which an employee, in this case the student, works with her or his manager to develop a set of objectives and outlines planned ways to achieve the objectives. At the end of a defined period, a complete circle (hence the term "360 degree") of peers, direct reports and managers evaluate your outcomes. The process also includes career planning and coaching. We used this tool to stress how important evaluation and assessment processes are to advancement in industry and get across the message that it is a tool to use, not dread. Assessment is a critical process to understand as it determines advancement and wage increases. As important,

it introduces students to how to handle and effectively use and respond to both positive and negative feedback.

The project was set up by Bob DeCarli of Lockheed Martin. Each student was reviewed by a peer in the class, someone they have mentored (direct report) and two "managers": the course instructor and the student's industry mentor. Other course projects included development of career plans working with Jean Chamberlin of Boeing; global diversity with Bob Hemler; workplace communication with Alex Noel and Mike Bober of ExxonMobil; and development of personal financial plans based upon projected (or in some cases real) post-graduate salaries. The latter is clearly an important component of the course: Students were shocked (shocked!) to discover taxes.

The course is coordinated and taught by the Director of the Women in Engineering Program who is also a faculty member.

## **COURSE DEVELOPMENT**

The development of Career Strategies for Engineering Women is based on an outline proposed by the Women in Engineering Program Advisory Board. The Board worked on the concept over a period of two years, beginning with a discussion of what they and their companies perceived as lacking in new hires; what they thought were critical skills for new hires to have; and how best to prepare women for success in the engineering workplace. The group met with faculty, recent women graduates, current undergraduates and each other. After recommending the development of an upper level class, individual teams were tasked to flesh out versions of a syllabus, proposed class projects and an industry mentor system.

The course has been offered once and feedback and assessments will be used to continuously improve the offering. WEP has firm commitments from industry representatives for course presentations and/or development of specific materials for the course and are working to improve and increase these offerings. The semester-long team projects and a core of case studies and of assignments that involve real world challenges and solutions have been developed and will be enhanced based upon the first course offering.

## **ASSESSMENT FOR PENN STATE CAREER DEVELOPMENT CLASS, SPRING 2004**

Initial assessment results for the small pilot offering indicate that the course is successful in achieving the stated objectives. While these results are interesting and will help in continued development of the course, meaningful results will depend upon gathering longitudinal and survey data from a larger group of students.

Three methods are being implemented to assess the course and course objectives:

- 1) Pre- and post course survey
- 2) AWE Longitudinal Assessment of Engineering Self Efficacy survey (LAESE).<sup>3</sup>
- 3) Tracking for retention and performance

The longitudinal study is part of a larger study for which the WEP director is a co-PI. This NSF-funded project is developing national assessment instruments for Women in Engineering Program activities. The instruments under development, including those to measure self efficacy, student activity assessment, and mentoring, were administered to all participants. In addition, participating students will be tracked after graduation to gauge the impact of the course on their career decisions and successes through individual interviews and through the College of Engineering alumni survey. These data, as well as tracking for retention and post-graduation reports, will provide near term and longitudinal data for formative and summative use. Data for items 2 and 3 are gathered and will be analyzed and reported as the reports are completed.

Results from the post course survey were overwhelmingly positive. Students took a post-course web-based survey that mapped to the course objectives. Of 11 students, 10 completed the survey. Respondents reported that they got a better sense of workplace tools (9 agree/1 neutral); have thought more about a future career (9 agree/1 disagree); thought more about what they would be doing in five years (9 agree/1 neutral); better understanding of financial planning (10 agree); better idea of how to balance life and work (10 agree); met professionals they contacted outside of class (9 agree/1 neutral); plan to keep materials from class for workplace reference (10 agree); learned things that provide a headstart in the workplace (10 agree); met professionals they intend to stay in touch with (9 agree/1 neutral); were motivated to do better in course work (6 agree/4 neutral); were motivated to succeed (9 agree/1 disagree); have an understanding of how to discern cultural values of a company (10 agree); will consider a company's workplace environment (10 agree/1 neutral).

One student in particular was uncomfortable with some of the organization and outcomes of the course. One of the continuing issues in offering the course provided a challenge for the students participating—constant change in the syllabus. Because the course depended a great deal on delivery by industry professionals, the schedule necessarily changed frequently. We explained to students that frequent change is a realistic expectation in the workplace and therefore a valuable part of what they were learning in the course, it was difficult for them to adjust to a syllabus that could change from week to week. Setting clearer expectations about this, along with discussions of change management, will be stressed early in the next offering and revisited throughout the semester.

Students reported that their expectations for the class that fell into these general categories:

- Finding out what to expect in the workplace;

- How to transition to the work place, find out more about opportunities for women in the workplace;
- Gain interview and job seeking tips; and
- Be in an interactive class.

All reported that they were met. All but one student reported that they thought in depth about areas covered in the class for the first time. All would recommend the class to the friend. Student comments include:

*"The course has well exceeding my expectations and provided me with a foundation to have a successful career."*

*"This class was all I expected and more. I had no clue I would communicate with corporate [people] and enhance my career building skills so much."*

*"I liked that the industry reps were professional and had good advice, but they were also able to give an 'insiders perspective' and tell us what we really needed to know once we graduate."*

*"[My expectations] were met and exceeded. I must say that I learned more from this class than I did in any other. Classes usually teach you the engineering basics. However, they forget the engineering basics that include how to work as an engineer, how to work in groups with gender differences as an engineer, and how to begin being an engineer in the working world. The actual arithmetic and science is only half of what is in store for me, the environment and business issues involved are also very important."*

*"Although none of the topics were 'new' to me, they were beneficial in reinforcing ideas and preparing for success in industry. Additionally, covering topics in a class and writing journal entries just makes you THINK more about the concepts. The one topic that I did THINK much more on than I had before is gender communications."*

*"I would have the students keep a portfolio because the information taught is so valuable. Also, I would have the final presentations be different topics, so a variety of topics are covered."*

Other, informal data, include communications received from students now in the workplace. One example, sent by an alumna of the class who is currently in industry:

*"I wanted to let you know that everything I learned from your class has greatly helped me transition from school to work. I know exactly what to ask my boss about performance reviews and how to make a great first impression on the job!"*

*"Just writing to ... let you know that I'm going through [a] Personal Business Commitment & Individual Development Plan. The process of going through objectives in engr 497 is proving to be very useful!!! I feel like I have a whole jump start on the process :-)"*

## CONCLUSION

The Penn State Career Strategies for Engineering Women was developed through a highly successful partnership of industry and academe. The collaboration produced a class that is rigorous, meets upper level curricular standards, and productively involves outside presenters.

The course was designed to help prepare engineering women for the workforce through a combination of skills, introduction to methodologies and practices, and role models. The pilot offering indicates success but a true evaluation of the course's ability to meet the stated objectives will have to wait until there are more participants (through future course offerings) and longitudinal data is collected.

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