Developing an Integrated Freshman Seminar for Women in Technology: An Innovative University-Corporate Partnership Model

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Abstract

According to a recent report by the National Council for Research on Women, at least half of the available science, engineering and technology talent pool will be women. Therefore, it becomes imperative to retain more women in these disciplines. Increasingly, companies and corporations are seeking to diversify those areas of their workforce that are predominantly male. In 2002, a partnership was developed between the School of Technology at Purdue University and John Deere to create a retention vehicle for beginning women students in the School. In this paper, we will present an overview of the freshman seminar *Women in Technology: Exploring the Possibilities,* which was developed as the result of this partnership, and discuss the model that integrated the course, the student organization Women in Technology, and the living/learning community created to support these efforts.

Introduction

A July 2001 report released by The National Council for Research on Women asks, "Where are Women and Girls in Science, Engineering, and Technology?" The past two decades saw the implementation of a variety of programs that succeeded in attracting more women into the fields of science, engineering, and technology. However, although women constitute 51 percent of the population of the United States and 46 percent of the labor force, only 23 percent of those who are employed in this country as scientists and engineers, across all degree levels, are women.[1,2] More recently, the National Council for Research on Women found that much of the progress that women made in these areas has stalled or eroded.[3] Their report underscores the increasing need for a scientifically and technologically literate workforce as we enter the new millennium.

Women and girls will comprise at least half of the available science, engineering and technology talent pool. Therefore, it becomes imperative not only to attract but also to retain women and girls in these disciplines. Young women entering colleges and universities in the areas of science, engineering, and technology are disadvantaged by their lack of computer experience and, we hypothesize, other technology experience as well.[4] They appear to have career goals that are not as well defined as those of their male counterparts, and often lack confidence in their abilities.[5,6] They may also encounter college and university classes that are unfriendly to them, impeding their learning. The absence of women faculty and mentors both within the classroom and outside of it, few women peers in their classes, and the lack of supportive networks can create a "chilly climate" for women in non-traditional fields. It is during this critical period that many of them transfer into other fields.[3,7]

The literature points to a need for a critical mass of women students in order to encourage their full participation in courses and to retain them within historically male-dominated fields.[8,9] A recent MIT conducted longitudinal study indicated that when the percentage of women students exceeds 15 percent, the self-confidence and professional aspirations of women students increase, "and their academic performance becomes equal to that of men" (p. 57).[10] However, critical mass is not enough to ensure women students' success in non-traditional disciplines. Wolf-Wendell observes that schools and departments must be "providing a supportive culture … fostering an effective community" (p. 339).[11]

This paper presents an overview of the freshman seminar *Women in Technology: Exploring the Possibilities,* which was developed as the result of a partnership between John Deere and the School of Technology at Purdue University; and discusses the model that integrated the course, the student organization Women in Technology, and the living/learning community created to support these efforts.

Background

Purdue's School of Technology consists of eight departments; seven of them are technologically oriented while the eighth, Organizational Leadership and Supervision (OLS) is human resource focused within this context. Table 1 documents the fact that the School of Technology enrolls 13% women students, the lowest enrollment of women students of all the Schools at Purdue.

Despite the growth of career opportunities for women in all areas of technology and heavy efforts to recruit women into technology-related fields, the School of Technology lags behind Science and Engineering in percentage of women enrolled. Additionally, as indicated in Table 2, the proportion of women students enrolled in the School of Technology has declined during the most recent six-year period.

Table 1.   Undergraduate Female Enrollments by School at Purdue University, Fall 2003

School	Percentage of Women	School	Percentage of Women
Veterinary Medicine	99	Agriculture	46
Education	82	Management	36
Pharmacy, Nursing, &	76	Science	34
Health Sciences		Engineering	18
Consumer & Family Sciences	69	Technology	13
Liberal Arts	62		

Sources: Office of the Registrar, School of Technology, Purdue University

Table 2.   Students by Gender at Purdue University, School of Technology

	1997		2003	
	Percentage	n	Percentage	n
Male	84.9	3,526	86.9	3,587
Female	15.1	629	13.1	536
Total	100.0	4,155	100.0	4,123

Sources: Student Services, School of Technology, Purdue University

A survey of women technology students revealed that they often face difficulties as they find themselves isolated in many of their classes, seeing few women role models with whom they can identify:[12]

Table 3. Women in Technology Survey Responses

	SA	A	U	D	SD
1. The professors in my technology classes treat women and men equally in the classroom.	20%	42%	6%	20%	12%
2. I am often one of only a few women in my technology classes.	33%	43%	4%	18%	2%
3. I participate equally in group projects with male teammates.	22%	44%	10%	22%	2%
4. I feel comfortable asking questions in class.	31%	37%	12%	18%	2%
5. I feel comfortable going to my technology professors for assistance outside the classroom.	20%	46%	10%	20%	4%
6. I feel confident in my abilities in my technology courses.	18%	52%	24%	6%	0%
7. I feel a technology career is an appropriate choice for women.	45%	25%	22%	8%	0%

n = 51   Miller and Wasburn, 2002

Nearly one-third of the women students surveyed are uncertain about or lack confidence in their technology skills. Nearly one third of them believe that the professors in their technology classes do not treat women and men equally, and approximately one quarter of them do not feel comfortable going to their professors for assistance outside the classroom. Although many of the women surveyed say that they feel confident in their abilities in their technology courses, nearly one-third are uncertain or disagree. Additionally, almost one-quarter indicate that they do not feel like equal participants when working on group projects with male teammates.

Strategies for Combating the Isolation

In 1989, noted education scholars John Gardner and M. Lee Upcraft asserted in their book *The Freshman Year Experience* that first-year seminars were one of the most popular and fastest growing curricular approaches used to increase first-year student learning in American higher education.[13] More than ten years later, the popularity of this approach remains.

In fall 2000, a survey of colleges and universities in the United States revealed that nearly 75% of the responding institutions reported offering a special course for first-year students called a first-year seminar, colloquium or student success course.[14] Whether presented as a single course with uniform content across sections, or a discipline-specific offering that varies by department, the appeal of this type of course relates to its established effectiveness in improving student retention and academic success.[15]

Research indicates that transition seminars can yield higher retention rates and higher grade point averages.[13,16] As a support and retention effort, the authors began to develop a course for

entering women students. It was part of an overall effort by the School to prepare women students with strategies to deal with some of the challenges attendant upon being a minority group within their individual programs/classes, and to provide them with a network of colleagues throughout their tenure at Purdue.

The John Deere Partnership

In 2002, the School of Technology received seed money from John Deere to launch the first year seminar that the authors had begun to develop. *Women in Technology: Exploring the Possibilities* was established as a first year seminar, tailored toward helping entering women students gain a better appreciation of the career opportunities available with a technology degree, the ways in which technology benefits society, and how women with technology-related careers balance work and family. The course was opened to one section of 23 students. The funds allow faculty to focus on the course by allocating release time from their current teaching workload.

As part of the Deere partnership, funds were made available to support bringing women professionals to campus to share their insights and experiences in the technology arena in order to motivate and encourage the students, and to answer their questions. They also provided competitive internship and scholarship opportunities for the women technology students.

The Course Structure

The course consists of three components:

Class discussion. Conversations surrounding case studies and videos serve as the basis for the class. Their purpose is to raise issues such as women in non-traditional careers, balancing work and personal life, women and power, internship opportunities, and women's leadership, and to provide an informal, supportive setting for discussing those issues. Students are encouraged to express their concerns about their courses, about life at Purdue, about their career plans, or whatever else is important to them that week.

Presentations by guest speakers. Women who have achieved success in a technology-related profession, many from major corporations, are invited to campus as guest speakers for the class, sharing their knowledge and experience about the many areas and career options available in technology. The variety of disciplines represented by the speakers serve to acquaint the students with the options available to them not only in their own majors but in others as well. The speakers also discuss the ways in which women balance their professional and personal lives, and students have an opportunity to sign up for lunch with them to continue the conversation.

Final class project. Students are given the opportunity to select one of several projects due at the end of the semester: (1) Investigate a career of particular interest and write a brief report detailing special requirements needed to enter the field, the specific job responsibilities, challenges that the job presents and strategies for dealing with them, what excites them about this job, etc.; (2) Job shadow and interview a female technology professional, and write a brief report describing her job, how she spent her day, the structure of the company where she works, and observations made during the visit; etc; (3) Read a book concerning women and the challenges they may face in their careers and write a brief paper critiquing the book, and discussing what

you learned and how it would apply it to your future career; and (4) Keep a weekly journal about their personal reactions to each of the class sessions.

Retention Goals of the Proposed Course

The retention enhancing strategies included in this paper are based on the theoretical framework developed by Tinto. He postulates that a student's decision to persist or withdraw is a longitudinal process dependent on his/her academic and social experiences in college and external influences on the student (such as the student's finances). These experiences affect the student's ongoing level of commitment to his or her college attendance goals, and the student's level of integration within the university community.[17]

The strategies also respond to the research literature on women in STEM disciplines, which indicates that they are much less likely to enroll in those disciplines than are their male counterparts. Those who do enroll are far less likely to remain.[3] Some reasons cited are lack of confidence in their math and science abilities, and lower levels of self confidence and self-efficacy, resulting at least in part from their lack of technological experience in college compared to men.[18]

All of the course components noted above serve to strengthen the retention of women students within the School of Technology: meeting role models, learning about the wide variety of career options, discussing the balance of work and family (one of the major concerns of women students considering technology-related careers), group discussions, assigned readings, and projects. Frequently, students do not consider career-relevant decisions until shortly before graduation. The women students in this course are encouraged to create a personal road map to career development and planning by which they can better navigate their subsequent semesters of work and study at Purdue.

Women in Technology Student Organization

In order to support its women students, the School of Technology created Women in Technology as a student organization in 1998. Its stated purpose was promoting the leadership of women in technology through networking, encouragement, mentoring, and outreach. Seventy-five women from the School of Technology joined the new organization.

At the end of the course, students are encouraged to join Women in Technology. Prior to creating the course, very few first-year students became members of Women in Technology. However, after hearing presentations by the student officers and getting to know one another during the class, many of these first year students feel empowered enough to make such a commitment. This student organization is a particularly effective vehicle for connecting women students during their undergraduate years, particularly since the instructors of the first-year seminar are also the faculty advisors to Women in Technology.

Women in Technology Living/Learning Community

Organizing students into learning communities is a strategy that can connect students on what

can seem dauntingly large and lonely university campuses.[19] Learning communities can be organized around common interests and curricula. "These can be used to build a sense of group identity, cohesiveness, and uniqueness … and to counteract the isolation that many students feel" (p. 42).[20]

Learning communities allow a group of students from the same major or with similar interests to take two or three of the same courses together. In the case of residential campuses, some Learning communities also allow students to reside with their classmates on the same residence hall floor. On both residential and non-residential campuses, curricular cohesion and relationships among the students and relationships among the students and faculty are stressed. Many colleges and universities have initiated learning communities to foster academic-based peer relationships, curricular coherence, interdisciplinary learning, and/or faculty interaction with students. Whether created as loosely linked cohort classes, team taught thematic interest groups, or some other form of course cluster, learning communities are fast becoming a method used across American higher education to increase student learning and success.[21]

In 2003, a Women in Technology Residential Program was created. Women students are assigned one floor of a residence hall where they both live and study. Upperclass women also live on the floor and serve as mentors/tutors. Whenever possible, the students take classes together as cohort. In addition, one of the authors serves as their advisor, giving them an opportunity to interact with a School of Technology woman faculty member outside the traditional classroom setting.

Evaluation Plan

In order to evaluate the effectiveness of the course design, the instructors will administer both pre and post tests to measure the degree of students' career knowledge and career commitment, and to measure the degree of change produced by the course. They will use a combination of qualitative and quantitative questions to assess the effectiveness of the course goals, speakers, class discussions, and peer group sessions (p. 210).[13] The surveys will be used to modify the course.

First semester evaluations of the course experience have been encouraging. Students rated the course 4.4/5.0 on a Likert scale where 1=strongly disagree, and 5 = strongly agree. Student comments on the course were positive:

> *I absolutely loved this course. I loved the support and networking as a result of this class, and I love how the professors listen to what I have to say and give my class and me feedback. If I could re-take this course I would, except I wouldn't want to re-do the project. I'm glad that students who've already taken the class are allowed to come back to observe later on if they like. Very nice feature.*

> *I really enjoyed this class. The instructors really made boring stuff fun!*

> *The course was very informal and had open discussions among other students. It was interesting to hear about what other's opinions were, especially from the guest speakers*

throughout the course. It was also nice to have the opportunity to have lunch with the guest speaker after class. Also, the lecture instructor gave personal insight on the topic of balancing family and career, which was helpful to hear first hand.

The instructors do a good job teaching the course. All of the speakers they have chosen have been very interesting and informative. It would be nice to be able to have people from all majors, however as it is not possible to do that in a semester, I like the fact that old students are invited back to listen to speakers of interest.

Similarly, the women students who elect to take the course will be surveyed upon graduation to determine whether there were lasting effects of the course. This set of data will be used to further modify the course structure and content.

The logic model methodology depicted in the figure below will be used to evaluate the effects of the course on retention.

Inputs → Processes → Products → Outcomes → Impact
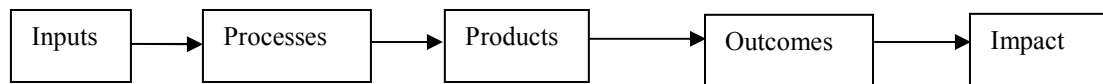
Furthermore, the evaluation will consist of both formative and summative evaluation. The formative evaluation will be used for evaluation of the processes and products, while summative evaluation will be used to evaluate the products, outcomes, and impact.

We anticipate using a quasi-experimental evaluation design to determine the effects of this program on retention. We anticipate using longitudinal surveys and peer review to evaluate the unanticipated effects of the program as well as the replicability of the model and broader impacts of the work.

Conclusion

For four years, the School of Technology had only a student organization to support the small number of enrolled women students. As noted above, the percentage of women students remained low as compared with the other schools. With the support of John Deere, the School has been able to integrate a freshman seminar, a living/learning community, and a student organization into a set of interrelated experiences that, when taken together, have the potential to dramatically increase the number of women students in the School.

Encouraging and supporting more first-year women students through the proposed course and building networks to sustain them through to graduation are a beginning. It is hoped that through such efforts, the climate for women students within the School of Technology will warm considerably and grow more conducive to their retention.

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