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WOMEN IN SCIENCE AND TECHNOLOGY: A FIRST-YEAR SEMINAR

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Abstract

First Year Experience (FYE) courses target entering students and introduce them to the college environment and expectations for the college classroom. These courses have gained increasing popularity due to their positive impact on retention of students, as well as increased graduation rates. This case study describes a FYE course implemented to try to improve the retention of women in information technology, information systems, computer science, and other scientific fields. We have already offered the course once and are currently offering it a second time. In this presentation, we will describe lessons learned and provide recommendations for developing similar courses at other universities.

Keywords: First Year Experience, information technology, women

IT: Not the Course of Least Resistance

Students choosing Information technology (IT) and other computing majors face significant struggles to complete the rigorous technical program of study required at the university level. Past studies have shown attrition rates of between 25% and 50% for computer science and information systems majors (Bryant, Hauser, Scott, & Shulman, 2000), particularly when they take the first programming course (Beise, Myers, VanBrackle, & Chevli-Saroq, 2003). Often, students who initially select computer science as their major switch to information systems (Perez-Quinones, Bryant, Springsteel, & Radimsky, 2000) or a less-technically challenging degree program early in their college career. As early as 1981, Behforooz & Sharma noted the insufficiency of early courses in providing problem-solving techniques and related concepts. Further, even when students understand and are able to succeed in technical courses, they still may not understand how to translate this knowledge to real-world activities (Tolhurst & Baker, 2003). The first college experiences are likely to influence retention rates for students interested in such challenging fields as IT.

Women IT Majors

The statistics available clearly illustrate that women do not choose or complete science and technology degrees as often as men (National Science Foundation, 2003; Trauth, 2002). Women face particular challenges when attempting to major in IT, computer science, information systems, science and math-related fields (Margolis & Fisher, 2002). Studies have suggested making the classrooms more gender friendly, including actively encouraging participation from both sexes (Brown University, 1996) to attempt to overcome gender-related issues.

Women tend to report more often than men that professors do not take an interest in them (Scientific American, 1998). The lack of support and mentorship by the professors influences their selection of a major. Mentoring has often been suggested as

an option that can positively impact females staying in IT and science-related disciplines (Didion, 1996; Miller & Kay, 2002; Trauth, 2002) at the undergraduate as well the graduate level (Holgate, 2000).

Recently, women have made many inroads in science-related disciplines. For example, in recent years, women have earned more than half of the mathematics degrees (De Palma, 2001). The same holds true for many science fields, including biology and chemistry. Why, then, has female representation in IT actually decreased over the last two decades? Researchers have called for studies into how to design intervention programs to recruit and retain women in IT fields (Blum, 2001). Further, intervention measures at various universities have shown great promise in increasing representation of women majors in computer science. For example, at Carnegie Mellon, 7% of entering freshman computer science majors were women, compared with 40% in the fall of 2000 (Blum, 2001), after intervention, recruitment, and retention programs were undertaken. Other universities (University of Michigan, 1996) have also reported similar successes after concerted efforts to engage, mentor, and retain women students.

Margolis & Fisher (2002) describe how universities must change in the following areas if more women are to be recruited, retained and graduated from IT programs: experience gap, admissions, good teaching, technology within context, culture, and secondary school outreach. Women and men report profoundly different experiences with computers and computing prior to attending a university. Men tend to have more experience with computers in general, and often their experiences may have focused on games. Because prior experience with computers does not seem to correlate with success in IT programs, it is important that admissions policies not favor those with computing history. Further, the context within which IT is taught can greatly impact its attractiveness for women. Women want to see real-world connections and connections with other disciplines. Applications and assignments that are limited to mathematics applications and computer games may hold little interest for many women. Furthermore, Margolis & Fisher tell us that “failures in pedagogy...affect women disproportionately” (p. 131). Therefore, particular attention must be paid to putting the most effective teachers into first and second year courses.

First Year Experience Courses

First Year Experience courses target entering students and introduce them to the college environment and expectations for the college classroom. Research has shown that such seminars are highly correlated to college success and degree completion. For example, Schnell, Louis, & Doetkott (2003) report increased graduation rates for students who take FYE courses. Crissman Ishler & Schreiber (2002) report that first year women in college have difficulty separating from friendships established during K-12 years, as they enter college for the first time. FYE courses may help these women transition into the college community. Donahue (2004) examined reflection essays written by freshmen students of both sexes, and determined that co-curricular activities may be important to typical students seeking new college bonds and relationships. Beaudin, Roth, Greenwood, & Boudreau (2002) also reported on a science cohort program that correlated with higher GPAs and the number of college credits earned. However, we are not aware of any study that examined the role of a first year seminar specifically designed for women who are interested in science and technology majors.

Targeting Women IT and Science Majors

In this study, we describe a first-year experience program that integrates the recommendations made by previous researchers (Blum, 2001; Miller & Kay, 2002; Trauth, 2002; von Hellens, Nielsen, & Beekhuyzen, 2004). Our long-term goal is to enhance recruitment, improve retention, and increase graduation rates for women by applying results from prior studies of women in science and technology. This paper describes a case study of a small group of targeted students. By improving the experiences of both students and teachers involved in the first-year courses (Tolhurst, 2003), we help students understand what is required of them to try to assure student success in IT-related careers, as recommended by Bryant et al. (2000). We further integrate the findings of other researchers, by focusing on problem-solving skills and real-world applications of technology. We also alert students to the gender inequities in IT-related fields and provide them with coping skills and intensive mentoring to attempt to reduce the attrition commonly seen in IT-related majors, and which is more pronounced in women IT majors than their men counterparts. In sum, we seek to outfit these students with the specific skills and knowledge that will allow them to flourish in science and technology.

First Year Seminar: Women in Science and Technology

During fall 2003, a special section of our First Year Seminar was offered for the first time. The theme was “Women in Science and Technology.” It was advertised with the following introductory paragraph:

Explore the myths and realities of a career in science, technology or mathematics. This section of <omitted> will focus on issues related to women interested in these 21st century careers. Students will learn how to influence these fields and dissolve the glass ceiling. In addition you will learn how to succeed in Calculus, complete a degree in a challenging yet satisfying career, earn a high income and change the world!

Our university routinely offers general purpose sections of the First Year Seminar, as well as some sections that focus on themes. First year students living in our campus housing are in fact required to enroll in a "Learning Community," which is a cohort group of courses that typically includes a section of the general First Year Seminar. Students receive three hours of college credit as they are introduced to college life and trained in successful strategies for getting the most out of college.

During this first offering, intensive, targeted recruiting of incoming freshmen led to a fairly diverse group of students including 19 women and two men. Initially there were a few more men who may have enrolled without serious intent to study the advertised topic. They dropped the class during the first week. The remaining group was composed of students who were excited about attending college, interested in promoting women in the sciences, and for the most part, interested in pursuing careers in science or technology. Students had declared majors in biology, biotechnology, chemistry, computer science, information systems, mathematics and nursing.

Each student was assigned a female faculty mentor in their indicated major or interest area. Mentors and protégés met early in the semester at a social gathering, engaged in periodic one-on-one advising during the semester, and met again at a social gathering at the end of the semester. Students worked with mentors to develop a plan for completing their undergraduate degrees, something most of them had not really considered yet. The final social gathering included the surprise appearance by our university president, who related some of her own negative experiences as a first year student who was initially interested in science.

The course content included several field trips, research on famous women in science and technology, and presentations by practitioners, researchers, and other professionals interested in encouraging this set of students. For example, biology faculty guided students through a tour of the university's greenhouse and arboretum, explaining environmental issues and problems. Students also visited our student services offices, learning how to navigate the many unknown services a university offers its students, including paying traffic tickets. Students were also required to attend and report on professional meetings, especially those offered by clubs in the sciences and technology. Classroom presentations included the following topics:

- Math Success and How to Use Your Programmable Calculator
- Top 10 IT Skills
- The Accidental Plagiarist
- Ethical Implications of the Information Age
- Myths of CSI
- Forensics and Biotechnology
- Panel of Female Seniors in Science and Technology
- Roles We Play - Skit and Discussion

This course was offered for the second time during fall 2004, and will be offered again during fall 2005. Due to time restrictions, it was not possible to engage in the same level of intensive recruiting for the class of 2004. As a result, very few of the enrolled students planned to major in science or technology. It will be interesting to determine if this early exposure encourages some of them to pursue a degree in science or technology at a future time. It will also be interesting to follow up with the students, especially the women who participated in the first focused, themed section of our FYE Seminar.

Next Steps

The high attrition rate of science and technology students – particularly IT and related majors – is not a new phenomenon. In our own university, we experience unacceptable completion rates in pre-calculus and the first programming course. Indeed, students have struggled to complete rigorous technical programs for years. For women, the rates of non-completion, change of majors, and other indications of disaffection are all correlated with the dearth of women in IT-related fields. We believe that by reaching out to these women early in their college career, over time, we can decrease the drop-out rate for women IT and science majors. Our experiences with fall 2003 and fall 2004 students inform our planning for the 2005 offering of this

themed FYE seminar. The 2005 version will be structured as a Learning Community, a cohort of three courses: this FYE seminar, the typical pre-calculus course for science students, and English composition. The three faculty involved are developing a tightly integrated program of study to emphasize women's success and natural place in the sciences and technology. We will also engage in intensive recruiting efforts to make certain that we attract students who are truly interested in these fields.

Recommendations

As with any case study, there are limitations to what can be generalized. Our university is a large public university where the majority of students are women, yet the majority of IT majors are men. The university is experiencing enrollment growth, primarily from traditional first year students emerging from high school. Thus, our experiences may be applicable to other similar university environments. We recommend that similar campuses wishing to attract women to science and technology consider creating a tightly focused first year experience for students who enter with an expressed interest in these fields. A cohesive, coherent focus on women in science and technology is critical to the goals of this course.

In sum, it is critical that women coming out of high school with an interest in IT and science-related fields be given an opportunity to succeed. Success is possible if the following areas are addressed, either through a course, or a cohort of courses: experience gaps, admissions policies, placement of the most effective teachers, providing a real-world context for the study of technology and science, as well as an honest examination and revision to the culture of the science and technology classroom. By implementing intensive mentoring and faculty-student interaction, using classroom role-playing, developing skills to help students complete technical courses of study, and increasing the awareness of potential difficulties faced by women in IT and science-related fields, we have already seen some limited success. We believe that women can and should achieve in the exciting fields of IT and science.

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