

Work in Progress -A Study of How Real-World Engineering Experience can Affect Women's Academic Career

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Abstract - Growing evidence has suggested that industry-sponsored project experience, where the student is paid, can provide students with a real-world perspective that enhances the student's academic experience. This experience is particularly valuable for female students because women may have less real-world exposure to applications in their chosen career path compared to their male counterparts. Sometimes internship experiences can be a negative experience for female students. Our working hypothesis is that internship experiences have the potential to affect female students more than male students, both positively and negatively. The focus of this paper is to determine if there are significant gender differences resulting from students' internship experience on academic performance and attitudes about their future career choice.

Index Terms - Cooperative-education, gender differences, professional skills.

BACKGROUND

Professional skills, such as those practiced during professional internships or co-op have become critical to engineering education¹. Industry-sponsored project experience can provide students with a real-world experience and a sense of relevance that may translate to improved academic performance. This experience may be particularly valuable for female students because women tend to have less exposure to applications in their chosen career path compared to their male counterparts. It is evident, from the level of participation, that companies have determined that co-op or intern programs are valuable to their recruitment and hiring plans. There is also evidence that cooperative employment influences students' skills and career choices². A study reported by Blair and Millea³, has reported a positive impact on academic performance for students who took part in a co-op program. In fact, females who completed a co-op program were found to have 0.26 points higher GPA than males, even though there was no significant difference among males and females who did not complete a co-op. A limitation to this study is that it did not separate the results by major. On the other hand, Seymour⁴ reports that the most common reasons for leaving science, technology, engineering and mathematics majors (STEM)

result from a loss of interest in the STEM fields or a rejection of the career lifestyle. The focus of this paper is to determine if an early exposure to STEM careers positively or negatively affect academic success and career attitudes and if there is a gender difference in these effects.

METHODOLOGY

It is hypothesized that project experience may benefit female students more than male students because of the aforementioned reasons. To determine the impact, we have conducted a focus group and designed a survey. The focus group was conducted to understand what female students thought the effect of internship experience had on their academic career. Based on the preliminary results of the focus group a survey has been designed to assess how their internship experience has affected students subsequent academic performance, particularly their professional skills and their attitudes towards their career choice.

The survey instrument is designed to measure three effects: (1) the quality of the internship experience, (2) the effect of the internship experience on professional skills, and (3) the effect of the internship experience on academic performance. Students are asked to report on their internship experience by answering questions such as: how much supervision they received, what was the quality of that supervision, were they treated professionally, was the work challenging or stimulating. We don't expect to measure a gender difference in the quality of the internship, but we want to be able to control for a bad experience. Secondly, students are asked to assess how the experience affected their leadership skills, teamwork ability, confidence, and preparedness for academic work following their internship. Finally, students are asked to assess the effect of internship experience on academic success and career attitudes following the internship. Demographic information (such as class standing, declared major, gender, and ethnicity) was also collected. Students were instructed that their participation was voluntary and that their responses are confidential.

RESULTS

The survey was administered through a web-based tool and 137 students responded: 101(74%) men and 36(26%)

women. The respondents were juniors or seniors in science and engineering majors who have participated in co-ops, internships, or paid research projects. The following text describes the preliminary results.

Preliminary Results of focus group

A focus group was conducted in with current female students in electrical and computer engineering and computer science. The purpose of this focus group was to gather information from the perspectives of the students about how the university can better serve female students in the fields of science and engineering. One of the questions that students were asked is: 'How do internship or research experiences affect your decision to remain in this discipline or your interest in your discipline?'

Those who reported having an internship stated they gained confidence in their ability and felt 'important' as a result of their internship. They reported that they felt as if their male teammates contribute more on academic teams but following their internships they see this is not the case. They reported positive team experiences during their internship. They were also pleased to have found something they were interested in doing full-time and recognized job opportunities that exist. They also reported that their exposure to different disciplines allowed them to see how they can work together and compliment one another. However, anecdotal reports (from students who had left the school or major) showed that an internship can be a negative experience for some students (perhaps a minority). A survey was designed to quantify these effects with more detail.

Results of survey

It's estimated that a large number of students take part in internship experience at a company or a research organization mostly during their summer breaks. Since statistics are not kept, it is unknown how many or what percent of student interns are female. However we do have good records of the students who participate in internships at Rose-Hulman Ventures (RHV). RHV is a department of Rose-Hulman Institute of Technology, where student interns receive real-world experiences by working on technology and business development activities with outside clients. Students can work part-time during the school year and full-time in the summer. From these data we determined that, women are taking part in internships at a rate (15.1%) that is lower than the female enrollment rate (20.5%) in the STEM fields at Rose-Hulman. One possible explanation is that since a larger percent of female students are enrolled in science majors compared to engineering majors, more female students are taking part in research experiences rather than internships. Therefore we have expanded our definition of cooperative education experiences to include Research Experiences for Undergraduates (REUs) and we included these experiences in the survey.

Most of the students reported that they thought their academic classes prepared them 'fairly well' for the internship and the overall quality of the internship

experience was 'above average' or 'excellent'. The students reported a positive effect of the internship experience on their professional skills, and confidence. A positive internship experience can have long-term benefits for the student because most students reported that they completed their first internship after their sophomore (50%) or junior year (28%).

Statistical T-tests were conducted to determine if there are any significant differences in the responses based on the gender of the responder. For the most part male and female students reported consistent responses to the questions except in three cases. First, female students compare to male students reported that they were more likely to 'take a leadership role in study groups or team-based projects'. Second, female students compared to male student also reported that they are more likely to 'speak up or voice [their] ideas in a formal or informal group environment'. Both responses were found to be significant ($P < .05$) based on the T-test. The survey confirmed the hypothesis based on the focus group; that positive internship experiences have a larger impact on the future academic experiences of female students compared to male students.

A third question that resulted in a marked different response from female students compared to male students was not predicted. Students were asked to indicate their goals in participating in an internship. The possible responses were: to obtain real world experience, build experience, connect the classroom to the real world, develop professional contacts, or other. A large number of students selected 'other' and indicated that one of their goals was to earn money. Based on the write-in responses 19% of men and 8% of women indicated that one of their goals was to earn money. At least one student suggested that an internship gave them an opportunity to earn more money than other jobs they had experienced.

DISCUSSION

Since a positive internship experiences has a larger impact on the future academic experiences of female students, it may be important to explore the idea of using internships as a retention and recruitment tool for women in science and engineering majors.

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