Coordinated Efforts for Developing, Recruiting, and Retaining Women in Engineering

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Abstract

There are various reasons why women account for less than 30% of the science and engineering workforce. These reasons include a lack of female role models, gender stereotyping, and less family-friendly flexibility in the STEM fields. In order to develop an interest in the science, technology, engineering, and math (STEM) fields and recruit females into these fields, Grand Valley State University (GVSU) has been running a Science, Technology, and Engineering Preview Summer (STEPS) Camp for female students entering the seventh grade. The STEPS Camp provides female role models in the STEM fields, dispels stereotypes, and helps foster an interest in science, technology, and engineering.

One effort used to retain females that enroll in the engineering program at GVSU is the Society of Women Engineers (SWE) student chapter. The SWE student group provides the female engineering students with a welcoming atmosphere and sense of camaraderie. Since the student chapter was started at GVSU it has been growing in size and vitality.

Introduction

A report from the National Science Foundation finds that women account for less than 30% of the science and engineering workforce[1]. The number of women participating in engineering at the bachelor's level in 2010 was only 18.2%[1]. Math skills are one of the fundamental skills required for success in science, technology, engineering, and math (STEM) degrees. However, Hyde et al. have found that by 2005 girls were performing as well as boys in math[2] and the National Center for Education Statistics has found that high school girls were earning math and science credits at the same rate as boys, with grades in these classes that are slightly higher than the boys'[3]. Reasons for the lack of women in the science and engineering workforce include a lack of female role models, gender stereotyping, and less family-friendly flexibility in the STEM fields[4].

In order to develop an interest in the STEM fields and recruit females into these fields, Grand Valley State University (GVSU) has been running a Science, Technology, and Engineering Preview Summer (STEPS) Camp for female students entering the seventh grade. The STEPS Camp provides female role models in the STEM fields, dispels stereotypes, and helps foster an interest in science, technology, and engineering.

The American Association of University Women (AAUW) has identified steps to support women who are majoring in STEM fields. One of the steps is to sponsor seminars, lunches, and social events for women in the department, while another one is to sponsor a "women in (STEM major)" group[5]. The Society of Women Engineers (SWE) is one such group that has among its core values to "embrace diversity in its broadest interpretation and commit to creating an inclusive environment" as well as to "provide an organization that fosters mentoring, and the development of professional and personal networks"[6]. Supporting a SWE student group at GVSU is one method being used to allow the female engineering students to create networks with professional women engineers that act as role models. The group also provides the opportunity for the female students to socialize with each other outside of an academic setting as well as to participate in discussions, workshops, or seminars on topics that are of importance to them.

STEPS Camp at GVSU

The GVSU STEPS Camp is for girls that will be entering the seventh grade. It is an aviation themed four-day camp to introduce science, technology, and engineering. The primary objective of the camp is to increase the number of females, especially females who are members of under-represented groups, entering the engineering profession. The methods used to accomplish this is through building self-esteem, confidence, and self-efficacy; increasing content knowledge and interest in science, technology, and engineering; and nurturing teamwork among the camp attendees[7]. The STEPS Camp is offered in two separate sessions with approximately 40 girls attending each session, with approximately 950 girls completing the camp over the past 11 years.

The STEPS camp also targets to achieve a 30% participation level by students from under-represented populations in the engineering profession. In order to accomplish this, three racially diverse middle schools in the Grand Rapids Public School District are visited in the recruiting efforts and free transportation is provided for the campers from Grand Rapids Public Schools. These efforts have resulted in participation levels of under-represented populations ranging from 14% to 38% in the past 11 years, with three of the 11 years having participation levels greater than 30%[7].

Campers are arranged into teams to work on constructing their own radio controlled airplanes. The final night of the camp allows each girl to fly the plane that she has built. In addition to flying her own radio controlled plane, each camp participant watches the landing of a fixed-wing airplane as well as a helicopter. Each camper also has the opportunity to fly in a four-seat Cessna aircraft during the camp. This can be a very exciting opportunity for the STEPS participants as there are often girls that have never flown in an airplane before attending the camp.

With the goal of the camp to increase the number of females entering engineering, science, and technology professions, the impact of the STEPS Camp has been assessed. A 10-year tracking study has determined that 47% of the campers declare an interest in science related careers, compared to 18% for a comparable peer group[7]. In addition, pretests and posttests are completed at the beginning and end of the camp weeks, respectively. The 2012 campers demonstrated content knowledge increases of 40% in aerodynamics, 43% in airplane parts and their functions, and 53% in process plans, achieving the STEPS Camp goal of increasing knowledge in the areas of aviation, physics, aerodynamics, chemistry, manufacturing, and assembly processes[7].

In addition to gaining content knowledge, making new friends, and having many new experiences, the campers are also immersed in an environment where they have female role models. There are female camp counselors, lead teachers, and speakers. Also, many of the activity leaders are females as well as the numerous volunteers that are needed to allow the camp to run smoothly each year. Studies have shown that females can experience improved self-efficacy through vicarious experiences with role models[8,9]. It is intended that the presence of these female role models will increase the campers' self-efficacy through their experiences with females in these technical settings.

The GVSU STEPS Camp has been run for over a decade with great results. Some typical responses from girls that have participated in the camp are: "I can do more than I thought and I could be a great engineer", "I can make a difference and I have potential", "Before camp when I thought of engineering I [thought] it was a job for men. Now I realize women can do it too", "I understand more things you can use for math and science", "Showed me more fun ways to use science and math", "STEPS influenced my confidence in math and science by making me realize that math and science is [interesting] to study, it's not boring"[7]. The STEPS Camp will continue to be held at GVSU in order to provide the young girls with a preview of the exciting opportunities available to them in the areas of science, technology, and engineering.

Society of Women Engineers Student Chapter at GVSU

One effort used to retain females in the engineering program at GVSU is the Society of Women Engineers student chapter. The SWE organization promotes the benefits of collegiate membership as being "part of a community of peers with access to exceptional tools, scholarships, training, and role models. And with all the recreational activities, it's a lot of fun, too!"[6]. The GVSU SWE chapter was established in the 2003/2004 academic year to provide these SWE membership benefits to the GVSU students. Since its inception, it has continued to grow in membership as well as in member participation and presents a welcoming atmosphere and sense of camaraderie for the female students. The SWE student group provides the female engineering students with an opportunity to socialize with other females in the engineering program as well as to meet professional women in engineering careers.

Although the GVSU SWE student group had been a recognized SWE chapter since the 2003/2004 academic year, it had not been an officially recognized GVSU student organization until the 2013/2014 academic year. In order to become an official organization, the officers for

the group prepared an application for review by the Student Organization Review Board. With the application, a constitution had to be prepared, outlining the organization's purpose, mission, and intent on campus, their anti-discrimination policy, which must be compliant with the university's policy, and how disbursement of the organization's resources would be handled upon disbandment of the organization. Within the group's constitution, they have outlined their goals to "strive to stimulate women to achieve full potential in careers as engineers and leaders, expand the image of the engineering profession as a positive force in improving the quality of life, and demonstrate the value of diversity"[10].

One of the benefits of becoming a registered student organization is that the SWE student chapter is now eligible for funding through the Student Life Fund at GVSU. In addition to this funding, the GVSU SWE chapter has also started to identify fund raising opportunities. Now that the group has a full executive board consisting of a president, vice president, treasurer, general secretary, and public relations officer, they have a strong, dedicated, group of individuals that are working to raise funds so that they can organize a group of students to attend SWE conferences, either at the local or national level. This is something that has not been possible in the past but has been identified as a high priority for the group to be able to connect with other SWE members and experience the full benefits of the SWE organization.

Some of the events that have been organized by the SWE student group, because they were deemed to be of importance to the group's members, are panel discussions with local professional women in engineering careers, social events with female faculty and local engineers, and even a book club to discuss a book about empowering women to achieve their full potential. The group has also taken advantage of the Collegiate Leadership Coaching Committee (CLCC) for SWE. The CLCC reaches out to collegiate sections to promote and foster leadership and section vitality. The topics that the group identified as being of highest priority for CLCC modules were building and keeping members and fund development.

The GVSU SWE student chapter has been in existence for a decade but it is still developing and establishing itself. With its dedicated members, it is identifying goals for the group and determining ways to meet those goals. It is the group's intention that the members will be able to attend a SWE conference within the next couple of years through increased efforts at fundraising.

Conclusions

Grand Valley State University has been undertaking activities to develop and recruit females into STEM fields through the Science, Technology, and Engineering Preview Summer Camp. This aviation themed four-day camp is an introduction to STEM fields form girls entering the seventh grade. After over a decade of STEPS Camps, the results of follow-up studies have shown that it has resulted in an increase in interest in science related careers by the camp participants. It also provides female role models through the counselors, lead teachers, speakers, and activity leaders.

Efforts to retain female students within the GVSU engineering program include sponsoring of a student chapter of the Society of Women Engineers. This group is continuing to grow in vitality

as the members realize the benefits of the networking with the fellow female students, professional female engineers, faculty, and SWE members on a national level.

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