

Affinity Groups: More Bang for the Buck

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Abstract

Retention of students in engineering programs is an on-going challenge. Many students are lost because of a decline in their interest in engineering, poor faculty pedagogy, or a feeling of isolation. The latter is a problem that is frequently encountered by women or other underrepresented groups in engineering programs. On commuter campuses there are additional challenges as the external environment continues to compete for the time and attention of students. This pull is particularly disruptive when a student is enrolled in a program as rigorous as engineering. Minority students and women often bring different personal and social histories to their college and engineering experience and they may require different persistence strategies. Students with higher levels of self-confidence tend to perform better and remain enrolled. Self-confidence tends to correlate with other positive indicators of persistence such as higher levels of interest in coursework, positive relationships with faculty, involvement in student societies, seminars, conferences and events, and participating in internships.

Research suggests that affinity groups can play a significant role in the persistence of women and minority engineering students by providing exposure to the field as well as opportunities to enhance the self-confidence of the student. Through affinity groups, students forge stronger relationships with faculty and tend to become more involved with the campus. St. Louis Community College at Florissant Valley was the first community college in the country to obtain a student chapter in the National Society of Black Engineers. Since doing so in the late nineties, the student chapter has played a significant role in retaining African-American students and attracting new students to the campus. This paper examines the value of this organization, the process for achieving this recognition and the accomplishments of the students over the last five years.

Introduction

The twenty-first century will be dominated by technological change as the United States economy becomes increasingly dependent on a technically literate workforce. Engineering is one of the careers that will help fuel the engine of economic growth¹. If the United States is to maintain its technological leadership in this interdependent global economy, it must take advantage of the entire pool of talent that the nation has to offer. Many major corporations now support the thesis that diversity makes good business sense. Hispanics, African Americans and Native Americans, however, still remain significantly underrepresented in science and engineering with roughly half of the science and engineering degrees awarded to minority citizens going to Asian Americans¹. The difficulty of meeting the engineering needs of the U.S. economy is exacerbated by a disturbing trend. Over the past twenty years, there has been an increase in attrition of engineering students. In 1975, the attrition rate for engineering freshmen was 12% and by 1990 it had grown to 24%². Less than half of the students who start college as

engineering majors actually graduate with an engineering degree. The attrition for minority students is approximately 70%³. Most underrepresented engineering students attend predominantly White institutions where the importance of mentoring relationships to the success of underrepresented constituencies is often underestimated. Although faculty can successfully mentor students across gender and ethnicity lines, there are some clear advantages that accrue when students of color are mentored by faculty of color or female students by female faculty. They can offer evidence of success that can resonate on a personal level. They present proof that diversity and excellence are not mutually exclusive. This advantage, however, cannot be readily achieved using faculty mentors from underrepresented populations, because their numbers are also low. Hispanics account for 3.1% of full-time engineering faculty/staff while African Americans and American Indians account for 2.8% and less than 1% respectively.

Without students of color entering science and engineering in representative numbers, there is little chance that there will be an increased presence among faculty. Within the next 50 years, minority students will surpass the number of white students on college campuses. More women currently attend college than men in virtually every ethnic category, yet women are underrepresented and often isolated in mathematics, science and engineering. They are also challenged in finding the role models, academic mentors, and cultural support that could improve persistence. The prospect of significantly increasing the population of minority and female faculty in science and engineering is daunting. The process is both long-range and costly. The greatest cost, however, may be in lost opportunity in motivating underrepresented groups to pursue careers in engineering, mathematics, science, and technology.

Astin, Tsui, & Avalos (1996) conclude that persistence in engineering is typically different than persistence in college because of the rigorous demands of the engineering program.⁴ Moller-Wong & Eide (1997) determine that switching is a significant factor in the high attrition in engineering⁵. Seymour and Hewitt (1997) examine the reasons that 40% of undergraduates leave engineering programs, 50% leave physics, and 60% leave mathematics⁶. One of the major findings of their research is that students who switch majors do not differ from those who do in the individual attributes of performance, attitude and behavior. The authors offer the following conclusion:

Contrary to the common assumption that most switching is caused by personal inadequacy in the face of academic challenge, one strong finding is the high proportion of factors cited as significant in switching decisions, which arise from structural or cultural sources within institutions, or from students' concerns about their career prospects. (p. 32)

They go on to suggest that the same problems that encourage students to leave science, mathematics, and engineering make persistence difficult for those who choose to stay. Landis (1995) also observes the negative impact that the culture of engineering may have⁷ on student persistence. Besterfield-Sacre, Atman, & Shuman (1997) conclude that students who switch may start out with the intention of graduating in engineering, but their general level of commitment is not as high as those who choose to stay.² Takahira, Goodings & Byrnes (1998) reinforce many of the previous findings about the culture of engineering and also suggest that inadequate advising and help also contributes to why students choose to leave engineering:⁸

Padilla et al. (1997) focus on retention by building an expertise model⁹. The underlying assumption of their model is that successful college students are experts at achieving success at a specific college. Students arrive on campus with a certain amount of theoretical and practical knowledge that they acquired throughout their academic careers. Once on campus the successful

students acquire the additional practical knowledge that is required to successfully negotiate the challenges of campus life. Typically this heuristic knowledge is not provided in a formal manner. Padilla, et al. (1997) identify four broad categories of barriers that successful minority students have to overcome⁹. They label them as follows: (1) discontinuity barriers which include obstacles to a student's smooth transition from high school to college, (2) lack-of-nurturing barriers which stem from the absence of supportive resources to facilitate the development and adjustment of minority students, (3) lack-of-presence barriers which occur when there is an absence of minorities in the college population or program, and (4) resource barriers related to insufficient financial aid. Reichert & Absher (1997) identify related barriers to African American success in engineering such as inadequate academic preparation, substandard educational resources, mismatched social and academic expectations, lack of encouragement, psychological intimidation, unstable familial and financial circumstances, inadequate peer support, lack of role models and mentoring, low expectations by faculty, racism, and poor instruction/advising¹.

Henes, Bland, Darby, & McDonald (1995) confirm that women are less likely to enter and persist in undergraduate engineering programs¹⁰. They also present five major reasons why women become discouraged with engineering. The first reason involves a sense of isolation that occurs in several ways. Prior to college, women are isolated from the engineering and technical professions to a much greater extent than their male counterparts. If they persist, they find that engineering students are isolated from each other in their early coursework. This isolation is exacerbated for women because of their relatively small numbers. A second reason for discouragement is a failure to see the relevance of theoretical material to the applied problem solving discipline of engineers. Many women may turn to other majors where the relevance is clearer. There is a similar pressure on men, but there is less isolation. A third reason for lower persistence by women is the increased intimidation that stems from lower rates of hands-on experience with mechanical and electrical devices, and less familiarity with the associated jargon. Although many men have similar experience levels, they are less likely to see their lack of experience as a weakness. The fourth reason cited for discouragement is the competitive environment of the classroom. Research indicates that women are less likely to ask questions and participate in class discussions than their male counterparts. The final reason cited in their research was the lack of role models whose very presence offers greater optimism about the likelihood of success.

Brainard & Carlin (1998) identify a number of factors that influence a woman's decision to persist in engineering or science, to switch to another major or to drop out of school altogether¹¹. They list the primary reasons for switching out of engineering as losing interest in the program, being attracted by another program, discouragement by academic difficulties, and perception of low grades. They suggest that some of the factors that increase persistence prior to a student being accepted in a department are positive relationships with an advisor, the influence of math and science classes, working, and gaining acceptance in a department. They also find that after students have been accepted into a department the persistence factors shift to the positive influence of a mentor, math and science classes, and participation in conferences and events. Brainard & Carlin (1998) also report that self-confidence is a factor in persistence and, to some extent, may operate independently from GPA¹¹. Self-confidence tends to correlate with other positive indicators of persistence such as higher levels of interest in coursework, positive relationships with faculty, involvement in student societies, seminars, conferences and events, and participating in internships.

Minority students and women bring different personal and social histories to their college and engineering experience than their White male counterparts, and they may require different persistence strategies. Hermond (1995) argues that colleges can play an important role in improving student retention¹². Reichert & Absher (1997) agree with Hermond (1995) when they suggest that bridge programs, engineering clubs, financial aid, academic advising, and counseling are important strategies in improving the retention of minorities¹.

The importance of mentoring relationships to the success of underrepresented constituencies in science, engineering, and technology is often underestimated. The problem cannot be easily met using faculty mentors from underrepresented populations because their numbers are also low.

Most underrepresented engineering students attend predominantly white institutions and within science and engineering departments the isolation is even more exaggerated than the campus population.

Changing the culture of engineering is not a short-term venture and there may not be agreement on what a new culture should be. The lack of representation among students in the academic pipeline makes it unlikely that there will be significant changes in faculty demographics in the near term. Financial aid will continue to be a significant factor in persistence for underrepresented students in engineering. Insufficient aid clearly has a negative impact on persistence, however, even when the aid is sufficient, students still face significant challenges to persistence. The sense of isolation, low confidence, inadequate advising and counseling, the absence of role models and mentors, and an antagonistic engineering culture work against persistence. Participation in socio-technical affinity groups can provide a powerful response to those factors that work against persistence.

Affinity Group

Affinity is defined in Webster's Collegiate Dictionary as "sympathy marked by community of interest" or "likeness based on relationship or causal connection." It has also been described as a "complex blend of familiarity, attraction and similarity that strengthens social relations" by fostering a sense of closeness among people." For the purpose of this discussion affinity group is used to describe a small group of students who meet and interact on a regular basis to facilitate personal and professional growth and development. This is accomplished by providing a safe and supportive atmosphere in which students can share experiences, exchange ideas, make recommendations to resolve issues, develop strategies for success, solve problems, and capitalize on emerging opportunities.

Affinity groups may form around disciplines, status, position, gender, race/ethnicity or any other cohort that acts as a connected subset of an organization. Industry has increasingly seen the value of supporting affinity groups in the work place. This paper will focus on gender and /race/ethnicity based affinity groups within the academic disciplines of engineering and technology. Because of the close connection and similar concerns, references will also be made to science and mathematics. Among the more recognizable affinity groups found on campuses throughout the United States are student chapters of The National Society of Black Engineers (NSBE), Society of Hispanic Professional Engineers (SHPE), American Indian Science and Engineering Society (AISES), and the Society of Women Engineers (SWE). The rationale for focusing on these particular affinity groups is the underrepresentation of African Americans, Hispanics, American Indians, and women in engineering.

Although student affinity groups may be connected to larger professional organizations, they differ from engineering professional societies that may also have student chapters. Part of the difference is rooted in the history and time of the formation of these organizations. Engineering professional societies were formed in the 1800s in the United States. They were formed with the intent of benefiting the profession, society and its members. There was no early vision of women and minorities being part of those organizations. They have all evolved to embrace the diversity that exists within the profession and it is no indictment of their intent to acknowledge that their membership still reflects the underrepresentation of women and minorities found in industry and the academy. It wasn't until 1950, when the Society of Women Engineers was formed, that there was a major statement about moving beyond engineering as a White male profession. The civil rights movement of the 1960s and the opening of college campuses to minority students laid the foundation for the formation of NSBE, SHPE, and AISES in the 1970s. Both types of groups make important contributions to the growth of engineering and technology, but an affinity group has a specific focus and culture that can attract and retain an underrepresented constituency. These latter twentieth century organizations could be described as socio-technical organizations and they were formed with the express purpose of addressing underrepresentation. There is a cultural component that is acknowledged and valued. It is this aspect of these organizations that make them well suited to address underrepresentation in engineering and the mission statements of both types of organization reflect their focus.

Mission Statements

- National Society of Black Engineers (1971)
NSBE's mission is to increase the number of culturally responsible Black engineers who excel academically, succeed professionally and positively impact the community.
- Society of Hispanic Professional Engineers (1974)
SHPE promotes the development of Hispanics in engineering, science and other technical professions to achieve educational excellence, economic opportunity and social equity.
- American Indian Science and Engineering Society (1977)
The American Indian Science & Engineering Society (AISES) is a national, nonprofit organization, which nurtures building of community by bridging science and technology with traditional Native values. Through its educational programs, AISES provides opportunities for American Indians and Native Alaskans to pursue studies in science, engineering, and technology arenas. The trained professionals then become technologically informed leaders within the Indian community. AISES' ultimate goal is to be a catalyst for the advancement of American Indians and Native Alaskans as they seek to become self-reliant and self-determined members of society.
- Society of Women Engineers (1950)
The Society of Women Engineers stimulates women to achieve full potential in careers as engineers and leaders, expands the image of the engineering profession as a positive force in the quality of life, and demonstrates the value of diversity.
- American Society of Civil Engineers (1852)

ASCE's mission is to provide essential value to our members, their careers, our partners and the public by developing leadership, advancing technology, advocating lifelong learning and promoting the profession.

- American Society of Mechanical Engineers (1880)
To promote and enhance the technical competency and professional well-being of our members, and through quality programs and activities in mechanical engineering, better enable its practitioners to contribute to the well-being of humankind.
- Institute of Electrical and Electronic Engineers (1884, AIEE)
The IEEE promotes the engineering process of creating, developing, integrating, sharing, and applying knowledge about electro and information technologies and sciences for the benefit of humanity and the profession.
- American Society for Engineering Education (1893)
The American Society for Engineering Education is committed to furthering education in engineering and engineering technology. This mission is accomplished by promoting excellence in instruction, research, public service, and practice; exercising worldwide leadership; fostering the technological education of society; and providing quality products and services to members.

The Society seeks to encourage local, national, and international communication and collaboration; influence corporate and government policies and involvement; promote professional interaction and lifelong learning; utilize effectively the Society's human and other resources; recognize outstanding contributions of individuals and organizations; encourage youth to pursue studies and careers in engineering and engineering technology; and influence the recruitment and retention of young faculty and underrepresented groups.

One of the central issues of an effective affinity group is the degree to which it is well-supported, integrated and actively involved with the larger organization, and free to address the issues and concerns that it has identified as priorities for the group. These organizations offer many of the advantages offered by student chapters of professional societies such as conventions/conferences, publications, networking, internships, and professional development. They also offer an experience that the professional societies cannot match. Publications are highly focused on the experiences and issues that confront underrepresented groups. Conventions and regional meetings provide the opportunity for students to be immersed in a professional atmosphere where the majority of the hundreds or thousands of participants are peers, role models, mentors, and achievers with whom they can identify.

On a campus level, students can speak freely and safely about the challenges confronting them. Even in the absence of regularly accessible professional mentors, the students interact regularly with classmates and upperclassmen that can show them the “engineering ropes.” Members of NSBE often refer to “NSBE Love” as a description of the relationship that members have with one another while SHPE refers to “SHPE Familia.” It is that family context that offers students a new feeling about engineering and its possibilities. The organizational advantages are not the only benefits. The connection and reinforcement at the campus level can be just as powerful if the affinity group is well constructed. Some of the characteristics of a well-designed affinity group include:

- High focus on relationships
- Regular student run meetings
- Multiple advisors, including representatives from faculty and a counseling
- Community service
- Tutoring/supplemental instruction
- Leadership training
- Peer mentoring
- High expectations
- Campus and community visibility
- Involvement in career development
- Recruiting and outreach
- Institutional support

The major objective is to build a critical mass of students who are nurtured, connected, and confident. In time, a culture is developed where success is an expectation, not only for the individual but also for the group. Students who are less isolated are more inclined to study in groups, participate in class and seek help. The increased visibility of these students may also change the way other students and faculty see them. Students who gather under these circumstances on a regular basis are likely to seek involvement and resources from external sources such as national organizations. Membership in national organizations, however, without commitment and connection on the campus level will have limited value.

NSBE – Florissant Valley

St. Louis Community College (SLCC), in partnership with the University of Missouri at Rolla (UMR), started a Cooperative Minority Engineering Transfer Program in 1988. Shortly after the program began, Emerson Electric Company joined the cooperative venture to establish a model program that has been successfully emulated at a number of institutions. The purpose of the program was to increase the pool of underrepresented students entering the field of engineering. The students who were recruited were not typically students who could begin at senior institutions with many of the students having ACT scores between 18 and 21. The early stages of the program did not achieve the anticipated success with a number of students deciding to withdraw from the program by switching majors. In the early going students experienced the sense of isolation and challenges that the literature addresses. Between 1988 and 1992, the persistence rates were little better than average with about 40% of the students continuing to graduation from UMR. Although students met regularly and role models were provided, the students were still largely isolated in their day-to-day experience. In the early nineties the campus committed more resources to the program in the form of counseling.

The additional nurturing provided through the combination of counseling, advising, and faculty guidance, started the shift in the culture of the students. A family atmosphere began to emerge and in 1994 a campus-based engineering club called the Society of Black Engineers (SOBE) was formed. The campus club met regularly and provided mutual support and encouragement. They became actively involved with the Student Government Association and by 1996 received honors as the best student club on the campus. They interacted with NSBE chapters on nearby campuses and became involved with NSBE as affiliate members in the organization. At the time, NSBE did not allow community colleges to form chapters. In 1997, four members of SOBE attended a regional conference of NSBE as affiliate members through the nearby Washington University Chapter. The experience was so profound that the officers

returned with a commitment to take as many members as possible to the next national convention. The commitment that had grown from the family-oriented nurturing and connection led to an extraordinary fundraising campaign that resulted in ten students with two advisors attending the 1998 National Convention in Anaheim, CA. The students were impressed beyond anything imaginable in seeing over 10,000 African American engineering students and alumni attending workshops, interviewing in the largest career fair in the country, and networking with students and professionals. SOBE committed itself to changing the restrictive policy of NSBE and by 1999 attended their second national convention as the first community college chapter in the United States.

Community college turnover is fairly rapid and each year new leadership has to be groomed. The impact of the National Convention and regional conferences is so energizing that leadership has not been an issue since 1997. The students are committed to each other and to the future of the chapter. In 2001, they entered their first competition and won the Region V history challenge. In 2002, the team chapter sent a team to compete in the Boeing Flight contest at the NSBE Convention in Orlando. In its first national competition the “Gateway to the West” team from Florissant Valley finished second to veteran UCLA in a field of 24 teams from universities around the country. The team also took top honors for overall design and was the top prize winner in cash awards. Four community college students (Marnell Berry, Bernard Keely, Jessica Roberts and Bryant Louis) from public high schools confirmed for non-believers what they had known from the beginning – that they could compete with students anywhere. Attending the national convention is an experience that all students should experience.

Conclusion

Many students are lost before entering the core of an engineering or technology program as a result of the isolation they experience. Research indicates that many students are discouraged by poor faculty pedagogy, preparation, and accessibility. Students also report being overwhelmed by the pace and competitive nature of engineering and technology programs. If the culture of engineering cannot be changed quickly, well-constructed affinity groups can create a supportive culture for the students. They can minimize the sense of isolation that students experience as they provide exposure to students who have not yet entered the engineering core courses.

There should be a particular focus on the needs that women and minorities may have for affinity-based organizations. These organizations should be supported at the institutional level and not left to student initiative alone. These organizations can effectively use the energy of successful students and existing external resources to improve the impact of orientation activities, tutoring, academic workshops, and supplemental instruction. This raises the question of how to use resources to make a difference in persistence. Institutions should encourage socio-technical affinity groups and utilize the power of the students to counteract the sometimes-oppressive engineering culture. It has made a remarkable difference in the positive transformation of Florissant Valley students. Further, the institution should do everything in its power to encourage and support students in attending, NSBE, SHPE, AISES, and SWE conferences. Other conferences for professional societies should also be encouraged, but for women and students of color, there is no experience more powerful than the impact of affinity groups. They really do provide “more bang for the buck.”

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