

AC 2007-2135: A REVIEW OF STRATEGIES EMPLOYED ON MINORITY RECRUITMENT AND RETENTION IN ENGINEERING EDUCATION

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Dr. Safai is a member of several international and national Professional Engineering Organizations such as: American Society for Engineering Education (ASEE), American Society of Mechanical Engineers (ASME) and American Society of Civil Engineers (ASCE). He has served in various capacities in these societies. He has served for ASEE; as a session chair, reviewer, and as the Division's Vice Chair for Annual Conference Programs for the International Division. Dr. Safai is responsible for bringing to SLCC engineering professional societies (ASME in 1992, ASCE in 2001). Nick is the ASCE chapter president for SLCC. He has organized several other student national & international societies and activities.

Nick has over 20 years of full time teaching experience and has received four outstanding faculty awards. He also has extensive managerial/administrative experience both in Industry and at academic institutions. For the past 10 years as the Head of Engineering Department (which consists of 9 engineering sub-departments), he has had major managerial/administrative duties. Nick has had the major role in starting the Engineering department and in bringing the 9 different engineering programs to SLCC which are all articulated with the institutions/ universities in the state of Utah. Nick has represented SLCC in a number of capacities including the Engineering Initiative of Governor Leavitt in State of Utah.

Dr. Safai has over 20 years of full time teaching experience and has received several outstanding contributions awards & honors. • He was the recipient of the 2005 SLCC Teaching Excellence

Award. • He received the 2005 Global Engineering & Engineering Educator Award for exceptional contributions to the ASEE International Division from the American Society for Engineering Education. • He received the 2005 best paper award from American Society for Engineering Education in the category of collaborations. • He received the ASEE Service Award at the 2005 Annual Conference in Portland Oregon. • He was the recipient of the 2004 Engineering Educator of the Year Award from the American Society of Civil Engineers (ASCE). • In recognition of outstanding achievements in the field of engineering and for service to society, he received the Utah Engineers Council (UEC) Engineering Educator of the Year 2005 award nomination. • He received the best paper award at the 2004 ASEE Annual Conference in SLC, Utah convention center in June 2004. • In October 1998 he received from SLCC the recognition for outstanding contributions and for exemplary work in helping the college achieve its goals (awarded by Computational Sciences and Education Division). • In October 1995 he received from SLCC the recognition for outstanding contributions and for exemplary work in helping the college achieve its goals. • He received from SLCC appreciation for academic expertise Math & Physical Sciences in February 1994. • May 1994 he received from SLCC the recognition for outstanding contributions and for exemplary work in helping the college achieve its goals (awarded by School of Science and Humanities). • Summa Cum Laude, 1972, bachelor of science in engineering degree. • Presidents list in 1968, 1969 and 1972 at Michigan State. • Michigan State's Dean's list 1970 and 1971.

A Review of Strategies Employed on Minority Recruitment and Retention in Engineering Education

Abstract

According to research nationwide, many students entering college confront developmental challenges and face difficulties while adapting to their new environment and coping with the greater demands of academic life. For minority students, these factors may involve obstacles different than those of their mainstream peers. Minority undergraduate student populations in the disciplines of science, technology, engineering, and mathematics lag significantly behind its representation in the overall population. Data from the U.S. census bureau and other studies indicate the population of African-American and Latinos to be between 12% and 13%, respectively. Undergraduate students falling in these groups account for only a small percentage of the undergraduate student population in the disciplines of science, technology, engineering, and mathematics. These minority student populations have increased slightly over the past decade, but are still significantly underrepresented.

To increase the attraction and retention of minority engineering students, many higher-education institutions have implemented various strategies to help address the academic and social pressures these students may face. The aim of these programs is to make the college experience problem-free and to improve retention rates, particularly of undergraduate students. Various institutions with accredited undergraduate engineering programs have an office or set of programs in place for minority engineering students. Typical programs include both social and academic support mechanisms.

The purpose of this paper is to review the various strategies employed by higher education institutions in recruiting and retaining minorities in engineering education. Some of the strategies reviewed include early exposure of students to engineering topics, advising, student participation in student competitions, teaching tools, recruiting packages, and scholarships.

Introduction

A college education is an important career move for any young individual whose desires to live the American dream. Such a move, while academic, on the whole has helped provide a foundation for establishing a successful life. While the importance of a college education is preached to young adults, colleges and universities must be one step ahead of their recruitment plan to acquire young minds by increasing and retaining student enrollment in their institutions. Although this task might sound easy, college officers are challenged to find a diverse mixture of students to fill their institutions' plethora of programs of study. Some of the fields which have difficulties in recruiting and retaining their students are science, mathematics, engineering and technology programs. This challenge is even more prevalent for minority students. After minority students are given the opportunity to attend a college, they are not always given the resources needed to be successful, while in that college.

To increase the attraction and retention of minority engineering students, many higher-education institutions have implemented various strategies designed to address the academic and social

pressures these students may face. The objective of these programs is to make the college experience problem-free and to improve retention rates.

The purpose of this paper is to review the various strategies employed by higher education institutions in recruiting and retaining minorities in engineering education. Some of the strategies reviewed include early exposure of students to engineering topics, advising, student participation in student competitions, teaching tools, recruiting packages, and scholarships.

Early exposure of students to engineering topics

Many colleges and universities are partnering with schools by introducing a kindergarten through 12th grade (K-12) engineering outreach program to introduce high schools students to engineering topics. This type of relationship is beneficial for both colleges and high schools because students are exposed to college courses and the colleges in return get a chance to promote their institution to the students.

Typically, such activities include summer outreach programs and are normally held by higher institutions for high school students from under-served communities. The program is set up like a camp and its purpose is to encourage students to pursue a college education and to introduce them to science and engineering programs in a stimulating atmosphere. These programs focus on changing the negative, preconceived notions about engineering so that the target audience will perceive it as a viable career choice.

Other activities used to expose students to engineering topics and concepts are accomplished through laboratory exposure. Some institutions of higher education establish an introduction to engineering lab at local high schools. The laboratory set-up employs active learning and smaller classes to better inform students about the nature of engineering and its specific disciplines. Research has shown that the overall perceptions of students concerning the engineering profession have improved as a result of their educational experience and exposure. According to a study done by Besterfield-Sacre et al., the attitudes of students towards the engineering profession improved in programs that implemented hands-on-design, project building skills, and innovative teaching approaches.¹

Scholarships

When students are determining which colleges they will attend, financing becomes a big part of the decision making. Providing students with monetary aid enables them to concentrate solely on their studies, reducing or eliminating their need for outside employment, thus accelerating their progress toward graduation.

A vast number of studies published concerning scholarships shows that financial aid is of vital importance when it comes to student retention. This becomes more important in the student's junior and upper-level years in college. For example, a study by Brainard and Carlin, found that financial problems continue to be a concern for approximately 20% to 30% of students throughout college.² Although their study focused on undergraduate women in engineering and science, it showed that financial hardship exists equally for minority students. A study by Robinson and

Soriano shows that about 30% of minority students leave college due to lack of funds and not because of their academic performance.^{3,4} Other studies list financial need as the biggest obstacle faced by most students transferring from junior colleges (i.e., community colleges) to universities.

Many studies have shown that scholarships, combined with other sources of educational income, have proven to be sufficient in enabling students to reduce or eliminate their need for work and allow them to concentrate fully on academia.

Understanding the role that scholarships play in the recruiting and retaining of students, some institutions offer financially disadvantaged student aid packages allowing them to complete their baccalaureate degrees in a timely fashion. Aid packages normally consist of grants, loans, and work-study funding. Financial aid packages are distributed based on criteria that students must meet in order to maintain their scholarship. The criteria normally include requirements that students remain in good academic standing (i.e., GPA requirements) and are enrolled on a full-time academic basis per semester/quarter.

Advising

Studies have shown that the first year of a student's life is determined to be the most critical time for new students arriving on college campuses. In the first year, students develop their undergraduate curriculum, which can ultimately determine whether a student will be successful throughout the remainder of his/her college career. Successful advising provides a one-on-one interaction for students, improving their educational experience, and establishes a foundation of success as they face social pressures.

Advising is an important part of steering students toward successful completion of their college degree. For minority engineering students, advising plays a central role in helping them stay on track and graduating on time. For many institutions, a more direct approach is used for advising. For example, from the time students declare engineering as their major, they are referred to the respective department and assigned an advisor within that department. This allows for the students and the department to maintain close contact and allows the department to monitor student progress more closely.

Some institutions establish a mentor-mentee relationship with their students. This type of relationship allows students to establish a point of contact with a university person. If students are having any academic problems, the advisor or the mentor must develop a strategy with the students to resolve problems and assist them in their academic career. In return, this helps students to enhance their performance in various courses.

Student participation in student competitions

Holding student science competitions is another method used by institutions for helping to retain students in their colleges. Some institutions provide funding to help encourage their students to participate in regional and national engineering competitions. These competitions are normally tailored toward getting engineering students to participate and apply their engineering skills and

knowledge of engineering concepts. Student participation in these competitions increases exposure to their respective engineering disciplines, problem-solving skills, and also exposes them to other fellow engineering students. This in itself enhances their knowledge and helps to motivate them in completing their degrees. According to a study by Patangia, student participation in competitions provides students with hands-on experience in which they can appreciate classroom knowledge and its application to real-world engineering problems.⁵ Such involvement has proven to be valuable for retention of minority and other engineering students, especially those who are at their freshman or sophomore level.

Conclusions

Recruitment of underrepresented student populations in science and engineering is of critical concern. To increase the attraction and retention of minority engineering students, many higher-education institutions have implemented various strategies to help address academic and social pressures that these students may face. These programs aim to make the college experience problem-free and to improve retention rates, particularly of undergraduate students.

The purpose of this paper was to review the various strategies employed by higher education institutions in recruiting and retaining minorities in engineering education. Some of the strategies reviewed include early exposure of students to engineering topics, advising, student participation in student competitions, recruiting packages, and scholarships.

References

1. Besterfield-Sacre, M., C.J. Atman, L.J. Shuman, R.L. Porter, R.M. Felder, and H. Fuller. (1996). "Changes in freshman engineers' attitudes – A cross institutional comparison: What makes a difference?" *Electronic Proceedings*, Institute of Electrical and Electronics Engineers' (IEEE), 1996 Frontiers in Education Conference.
2. Brainard, S. G. and Carlin, L. (1998). "A six-year longitudinal study of undergraduate women in engineering and science." *Journal of Engineering Education*, October 1998, pp. 369-375.
3. Robinson, T. (1990). "Understanding the gap between entry and exit: A cohort analysis of African American students' persistence." *Journal of Negro Education*, Vol. 59 (2), pp. 207-218.
4. Soriana, E. (1985). "Financial aid." In R. Landis (Ed.), *Improving the retention and Graduation of Minorities in Engineering*. NACME, New York, pp. 93-98.
5. Patangia, H.C. (2003). "A recruiting and retention strategy through a project-based experiential learning course." *Proceedings*. 2003 ASEE Annual Conference (Session 3448), June 22-25, Nashville, TN.