AC 2008-1874: ECAP: A RECRUITMENT-TO-GRADUATION PROGRAM FOR UNDERREPRESENTED ENGINEERING STUDENTS

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ECAP: A Recruitment-to-Graduation Program for Underrepresented Engineering Students

Abstract

According to the National Science Foundation, as of 2000, African Americans made up only 6.9% of the total science and engineering workforce and people of Hispanic origin made up only 3.2%. These figures exemplify the continuing challenge facing the engineering community to take advantage of the untapped talent among underrepresented ethic minorities and highlights the fact that these groups remain overlooked by current recruitment and retention approaches employed by universities.

This paper introduces the Engineering Career Awareness Program (ECAP) at the University of Arkansas. This program is an engineering diversity recruitment-to-graduation initiative to increase the number of underrepresented students entering and graduating from engineering disciplines. This program combines several piloted and proven recruitment and retention strategies into one cohesive program to recruit and retain minority students. The recruitment strategy is grounded in the education of students previously unaware of STEM career possibilities, highlighting the exciting possibilities of life as an engineer. Cornerstones of the retention program are: 1) A 3-week summer in-residence engineering bridge program for ECAP students to engage in engineering/teambuilding activities, make friends, and transition to campus life; 2) Renewable scholarships to supplement scholarships and federal grants to bring the students' total award to the University of Arkansas cost of attendance, thereby removing financial barriers and increasing retention for those who could not otherwise attend college; 3) Yearly paid summer co-op or research opportunities after the freshman year; 4) A peer mentoring program where the freshmen and sophomores are mentored by juniors and seniors who serve as mentors; 5) Involvement and leadership activities with a student organization of the students' choice; 5) An ECAP living-learning community where students live in a common community while solidifying academic and social connections; and 6) Freshman Engineering Program participation designed to increase retention of all freshmen students by providing a facility for freshman, specialized advising, tutoring, block scheduling, and a common introductory engineering course.

Our inaugural class of 21 minority ECAP students was recruited during the 2006-2007 academic year through targeted advertising and recruitment, and the second cohort of ECAP students is currently being recruited. The satisfaction and success of the current cohort is creating an additional pool of applicants in addition to those being created through other recruitment methods. The first cohort has attended the very successful Engineering Summer Bridge Program, and all began their engineering degree programs in fall of 2007. This paper will detail the recruitment and retention strategies used for the ECAP program, so they can be replicated by other universities. Quantitative and qualitative program assessment and evaluation will be included.

Introduction

It is imperative that engineering colleges respond to the significant demographic shifts in the national workforce. According to the U.S. Bureau of Labor Statistics, we can expect that during this decade the total labor force will expand by 17 million people and that minorities and women will become a growing percent of that workforce.[1] In the four-county area that comprises Northwest Arkansas (NWA), the population of minorities has increased to 102,987,[2] and the Latino population in NWA's Washington County increased 747% during a 13-year timeframe.[3] Likewise, the National Science Foundation predicts the demand for new science and engineering professionals to increase by 51%.[1] If the talent pool does not diversify, these professions will be unable to meet this demand and will be unequipped for the changing society. The need to diversify the workforce is an imperative that goes beyond what is socially appropriate. Diversity is required to meet the demands of a growing national economy. The challenge is in overcoming our self-imposed limitations by historically promoting practices that encourage exclusivity rather than reaching broadly to attract populations of talented people to make significant contributions to these professions.

Traditional barriers of access, retention and lack of role models must be "broken" to increase the number of engineers from underrepresented populations. The University of Arkansas' (UA) Engineering Career Awareness Program was developed to recruit, retain, and graduate engineers from underrepresented populations by removing these traditional barriers and nurturing student success.

Engineering Career Awareness Program (ECAP)

The ECAP program is an engineering diversity recruitment-to-graduation initiative to increase the number of underrepresented students entering and graduating from engineering disciplines. This program combines several piloted and proven recruitment and retention strategies into one cohesive program to recruit and graduate minority engineering students. Recruitment strategies are grounded in the education of students previously unaware of STEM career possibilities, highlighting the exciting possibilities of life as an engineer. Cornerstones of the retention program are: 1) a 3-week summer bridge program; 2) renewable scholarships to supplement scholarships and federal grants to bring the students' total award to the University of Arkansas cost of attendance; 3) yearly paid co-op or research opportunities after the freshman year; 4) peer mentoring; 5) student organization involvement and leadership; 5) a living-learning community; and 6) Freshman Engineering Program participation.

Recruitment Strategies

The UA College of Engineering (COE) is committed to increasing the number and diversity of students entering and graduating from engineering disciplines. Prospective students from underrepresented groups often face an "access" barrier. Improved educational opportunities for these students means providing access to improved information and opportunities not traditionally available. Over the last few years, UA engineering recruitment efforts have led to increasingly larger freshman enrollments, in contrast to the national decreasing trend.[4]

Additional strategies were successfully piloted by the COE to tap typically STEM unfamiliar populations.[5, 6]

Since ECAP is a new program, the initial recruitment strategies are targeted at high school students. Other programs in the COE are targeting middle school children - future ECAP students. ECAP recruitment strategies include those listed below.

Informational Outreach

Hurtado and Kamimura state, "Adopting aggressive recruitment strategies to increase Latina/o participation rates can result in identifying students who might otherwise not consider a four-year institution. This means that recruiting efforts need to be focused in demographically Latina/o-concentrated areas, involving counselors and parents in the application process, and coordinating with early outreach programs in high schools." [7] Increasing underrepresented student enrollment cannot be achieved from an administrator's desk or through web pages. Recruiters must travel to where the pools of prospective students live and learn.

ECAP informational recruitment strategies educate the prospective students' entire family on the exciting possibilities and benefits of an engineering degree, and illustrate how students can structure their high school (or earlier) curriculum in preparation for college. When parents learn about engineering as a profession, they spread the word to others through informal communication. Since prospective students cannot choose a major they are unaware of, this is an important part of the recruitment process and an investment in the future. Visits to high schools with high populations of underrepresented students, making presentations; visiting with teachers and counselors, and talking individually to students are often the first step. Targeted brochures, letters, web pages, personal phone calls and special events targeting these students are also very important.

Minority Student Recruiters

Student recruiters are particularly effective, because the prospective students easily identify with them. Prospective students trust the student recruiters are to tell the "real story" about majoring in engineering, and they see the recruiters as role models.[6] Minority engineering students participate in the recruitment of ECAP students, and ECAP freshmen of today will become the recruiters of tomorrow.

Alumni Ambassadors

A single engineer in his/her lifetime will influence and encourage many students to pursue engineering as a career, creating exponential ripple effects. Engineers are typically passionate and excited about their jobs so they tell neighbors, friends and family. The UA COE strategically mobilized ethnic minority alumni and trained them in proven recruitment techniques. The alumni volunteers recruit minority students in their surrounding schools and personally contact students who show potential to discuss engineering as a career and answer any questions. The alumni speak from experience and serve as strong role models. This program was piloted in 2007 and is being substantially expanded in 2008.

Scholarships and Financial Aid Information

Students from underrepresented groups are often first generation students who face additional barriers trying to navigate the scholarship and financial aid system; in fact, many families believe their children cannot attend college because of financial issues, when in fact they can. Recruitment strategies must provide understandable information to illustrate financial opportunities and provide clear directions on how students can secure these funds.

Partnerships with Minority Serving Institutions

As suggested by the National Science and Technology Council publication, "Ensuring a strong U.S. Scientific, Technical and Engineering Workforce in the 21st Century, partnerships between minority-serving institutions and research universities enrich the experiences of faculty, staff and students." [8] Creating alliances with minority serving institutions provides opportunities for mutually advantageous student recruitment through development of articulation agreements and dual degree programs.

ECAP Retention Strategies

The cornerstones of the ECAP retention program are six strategies, some of which are available to all students and some specific to ECAP students.

Summer Bridge Program

According to a 2005 study by the Educational Policy Institute, starting college at a four-year institution increased the likelihood of attaining a bachelor's degree by 29% for Latinos and 35% for whites.[9] Summer bridge programs are known to significantly increase the enrollment and success of students. The in-residence Summer Bridge Program brings ECAP students to the UA to successfully engage in engineering/teambuilding activities, make friends, and transition to campus life.

Scholarships, Co-ops/Internships and Undergraduate Research Experience

After the freshman year, the ECAP program provides opportunities for all students to have yearly paid Summer Co-ops/Internships or Summer Research Experiences. As recognized by the National Science and Technology Council, "There are many students for whom the greatest hurdle in their effort to obtain a science or engineering education is financial…Options such as scholarships, …traineeships, …, support for research experiences and internships have proven effective in providing incentives to students who pursue a career in S&E disciplines, while also providing them with a good grounding in what it is like to work in the S&E fields." [8] The program takes this statement to heart, embedding some of the methods mentioned above into our program.

Scholarships

Many low income students simply cannot go to college because the financial hurdles are too great, even with financial aid and some scholarships. In fact, in a study by Hably and McClanahan of four-year public universities, the amount of financial aid available to students was the primary factor contributing to attrition.[10] Although many low income students qualify for student loans based on the FAFSA evaluation, the reality is that many parents have poor credit or no credit and cannot obtain these the loans. The ECAP program removes these barriers by awarding scholarships to students that add to their other awards of scholarship and federal grant aid to reach the cost of attendance.

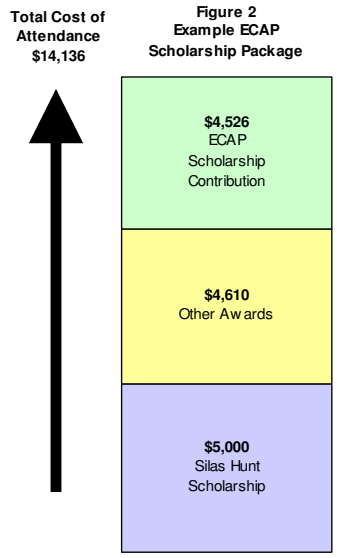

Figure 2 Example ECAP Scholarship Package

Many low income students do not remain consistently enrolled in school, taking semesters off to earn money to pay for the following semester or year. Keeping students continuously enrolled greatly increases the likelihood of bachelor's degree completion. The Educational Policy Institute found that if students remain continuously enrolled, the probability of graduation with a bachelors increased by 60% for Latinos and 42% for whites.[9] Scholarships allow students to spend more time on their studies, rather than working, thereby enhancing their GPA and their probability of graduation. In the 2005 Educational Policy Institute study, Latino students who earned a GPA between 2.5 and 3.91 increased their graduation rate by 47%, and whites by 42%.[9]

ECAP students are awarded renewable scholarships to supplement other scholarships and federal grants to match their total award to the UA cost of attendance, as shown in Figure 2.

Co-ops/Internships

The benefits of co-ops and internships are universally accepted throughout the engineering community. The experience helps students gain professionalism, visualize themselves in engineering careers and experience the real-world, all while providing financial support. All ECAP students will have a yearly co-op or internship experience.

The COE has a full-time staff member dedicated to developing co-op opportunities for students. Students who participate in co-op/internships graduate at a substantially higher rate than other students. In fact, students in the UA College of Engineering who participated in co-ops/internships had a 90% 6-year graduation rate.

Undergraduate Research Experiences

Students who have an undergraduate research experience are more likely to continue on to graduate school and are more likely to be awarded graduate assistantships and fellowships.[11, 12] Multiple NSF REU sites in STEM areas at the University of Arkansas engage students, particularly underrepresented students, in undergraduate research. The UA also has a George

Washington Carver REU program for ethnic minority students, recruited from 25 minority-serving institutions. 35%-40% of Carver Program participants return to the UA for graduate school.

Peer Mentoring and Leadership

During the ECAP Peer Mentoring and Leadership program ECAP freshmen and sophomores are mentored; juniors and seniors serve as mentors. The freshman year is the most important in terms of retention, because 57% of all students who leave from 4-year institutions do so within their first year.[13] Major causes of students leaving include academic and adjustment difficulties, incongruence and isolation.[13] Programs for retention must address the holistic freshman experience, since over half of freshman drop outs leave because of their first-year college experience, not their academics.[14] Student support during the transition to college is the prime influence on whether a student stays or leaves.[15] As a support mechanism, successful peer mentoring can significantly impact students' desire to remain in engineering and at the university, especially for minority students.[16]

Data also shows that mentors also gain significantly from their mentoring experience, both academic and interpersonally.[17] Freshmen who participated in the UA College of Engineering pilot peer mentoring program had a 14% higher retention rate than non-mentored students. Peer mentored students were twice as likely as their non-mentored colleagues to have a first semester GPA greater than 2.5, and the average GPA of the peer mentored students was 9% higher than that of their non-mentored cohort. All peer mentored students said that they would recommend the program to other freshmen, and all students rated the program a success.[18]

Freshman Engineering

The Freshman Engineering Program is designed to increase retention of all freshmen students. This program provides a facility for freshman, specialized advising, tutoring, block scheduling, and a common introductory engineering course. All freshmen entering the UA College of Engineering participate in the Freshman Engineering Program, which aims to establish a foundation for the academic and professional success of new students. The UA College of Engineering is piloting the new Freshman Engineering Program this year.

Living-Learning Community

Living-learning communities have become significantly more popular in the last several years due to their positive impact on student achievement and retention.[19] Shapiro and Levine present several case studies that illustrate this impact, from both the institutional perspectives and from the students' perspective.[20] In a study by Hably and McClanahan, four-year public universities were asked which three campus practices had the most positive effect on retention. Learning communities ranked second, with 18.4% of universities citing this strategy within the top three on campus.[10]

The UA COE has created an ECAP Living-Learning Community in which the students live in a common community solidifying academic and social connections.

Program Evaluation

ECAP is a groundbreaking program for the University of Arkansas and the engineering profession. As the inaugural year of the ECAP program, first year quantitative measures are incomplete at this manuscript writing time. Indicators do show, however, that the program is going well.

High quality underrepresented students were successfully recruited into the pilot 2007 ECAP cohort. Of these twenty-one students, 11 are from Arkansas, 10 are from other states; 18 are men and 3 are women; 7 are Native American, 5 are Hispanic American and 9 are African American. Their average composite ACT score is 27.8, and their average high school GPA is 3.87. Clearly this program attracted and provided opportunity to high quality students.

Recruitment indicators for the 2008 ECAP cohort are positive. As of January 2008, the UA COE has 48 ECAP eligible engineering-interested students and has already made 18 ECAP offers for Fall 2008 (compared to 16 and 0, respectively at this time last year). Having an earlier start in the Fall was helpful, and parents are calling to inquire about the program, indicating that informal networks are helping the recruitment effort. The number of targeted large minority population schools was expanded, as well.

For the 2007 cohort, one Alumni Ambassador training session yielded 10 alumni volunteer recruiters. This effectively increased the number of engineering recruiters in the field substantially, and for a very low cost to the College of Engineering - a large jump in recruitment team efficiency. Alumni Ambassadors can be credited with "closing the deal" with at least six of the 21 ECAP students in the 2007 cohort. The COE is significantly expanding the Alumni Ambassador program.

The diversity-related ECAP recruitment strategies resulted in an increase in the engineering minority freshmen enrollment of 17% over the previous year, even though strategies only began in Spring 2007 (very late for the recruitment season).

Compared to this time last year, the number of engineering-bound minority students admitted to the UA has increased 71%. Largest increases were a 93% increase in the number of African American students admitted and an 83% increase in Hispanic American student admitted.

The UA Scholarship Office director credited the ECAP program with increasing the effectiveness of the Silas Hunt Scholarship program (a campus-wide underrepresented student scholarship program), including playing a large factor in a 79% scholarship acceptance rate in 2007, compared to 60% in 2006 prior to the ECAP program, and a 62.5% increase in scholarship applications from African American and Hispanic students in the last year. He credited the ECAP program with having a "dramatic impact on how we recruit top minority students at the UA."

The summer bridge program resulted in 100% of the attending students returning for their freshman year in engineering – an unusually high yield rate for a bridge program. Students were extremely positive about the program, and all of the students wanted to stay longer than the 3-week program.

As of mid-January 2008, three of the twenty-one ECAP students dropped from the program. Although transferring out of engineering, all three are still attending college (two at UA, one at another 4-year institution). One student wanted to be geographically closer to his girlfriend and will major in chemistry. The second student wanted a less demanding program and transferred to architecture (unconvinced that it was a demanding field). The third student did not enjoy engineering and became an undeclared arts and sciences major. All other students feel confident and happy in their engineering degree program and are in good academic standing. Transfer students will fill the open positions from attrition.

Although the ECAP living-learning community was required only for the freshmen year, the students have asked to be housed again together and continue the community.

In December 2007, students were asked questions about their ECAP experience to-date. It is clear that ECAP had a profound effect on the students and their families. A few example quotes from students are provided here:

When you were selected for ECAP explain the reaction in your family.

- It was a pure blessing. My grandma cried and told me she loved me and she was proud of me. ECAP was a dream come true.
- Ecstatic! My mom cried. (Happy tears)
- They were ecstatic. It took a huge weight off of their shoulders.
- Back flips and relief and excitement and accomplishment.
- They threw me a party with cake and food.

Explain the impact (if any) ECAP has made in your education and experience.

- It made me try a lot harder knowing that I had to keep it otherwise my parents really couldn't afford it. I really can't express how much I appreciate this.
- It has made it amazing. Not having to work or worry about loans has made my first semester immensely better, and I can work harder on my studies.
- I am so thankful for ECAP! I know that my first semester would not have been so amazing if it weren't for the 3-week orientation and all my ECAP family.

Explain the impact (if any) ECAP's Thomas Carter (TC) has made on your experience at the UA. (Authors Note: TC runs the daily operation of the program and serves as an ECAP recruiter and mentor.)

- He has given me my college education and advice and support. This is important, because I am so far from home.
- TC has impacted everyone as being as a father figure on campus. He is a mentor to everyone in trying to lead us to success.
- He is ECAP's daddy. He gives good advice and you can go to him with any problem and he will help you with it. TC III is awesome.

- He keeps all of us ECAPers together and I believe that all of the rest of ECAP feels the same towards TC as I do. I appreciate everything he has done for me and the opportunity that he has given me.

Summary

As described by the recent National Academies book "Rising Above the Gathering Storm," there is a great need to address not only the issue of diversity, but also the predicted future shortage of engineers overall. The ECAP program addresses a very important need in the state of Arkansas and simultaneously assists the engineering profession nationally by addressing diversity and the predicted future shortage of engineers.

The goal of the Engineering Career Awareness Program (ECAP) is to increase the number underrepresented students who obtain engineering degrees and enter engineering graduate studies or the engineering workforce. In its first year, the ECAP program has been a success, resulting in an expansion of the recruitment program and the recruitment of another incoming class of twenty-five students.

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