AC 2012-4939: LESSONS LEARNED FROM A PROGRAM TO ENCOURAGE AND ENABLE TRANSFER STUDENTS TO COMPLETE THEIR ENGINEERING DEGREES

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Lessons Learned from a Program to Encourage and Enable Transfer Students to Complete their Engineering Degrees

Introduction

Our Engineering Department is working to increase the number of community college transfer students in our engineering program through a National Science Foundation funded S-STEM grant. The goal of the grant, "Engaging the Community to Achieve Success in Engineering" (ECASE), is to encourage and enable academically talented, but financially needy students from local community colleges to enter the workforce or continue in graduate studies following completion of a baccalaureate degree in electrical engineering at Seattle Pacific University. Our specific objectives are to 1) provide community college transfer students (our ECASE Scholars) with full ($10,000/year) or partial ($5,000/year) scholarships for up to three years to complete their electrical engineering degrees in our program, 2) increase significantly the diversity of our incoming engineering students, 3) maintain retention rates significantly above national averages, 4) increase the number of well educated and skilled engineers in the workforce, and 5) institutionalize our focus on community college transfer students. This paper is focused on the lessoned learned (positive and negative) thus far in our efforts to achieve each of these objectives. We will use these lessons in the implementation of our new S-STEM grant, ECASE-II.

ECASE Criteria and Selection Process

To qualify for the scholarship, applicants must demonstrate financial need (based on the results of FASFA), show proof of US citizenship, permanent residency, nationalization, or refugee status, and qualify as a full-time student. In addition, applicants are evaluated on the following award criteria:

- Academic talent, as demonstrated by their academic transcript (GPA's of 3.00 or higher are preferred; SAT scores are optional);

- Preparation for engineering, as demonstrated by completion of an Associate of Arts or Science (engineering track) degree or equivalent, or completion of one year of calculus and physics;

- Recommendations from two sources; one from a high school teacher, college professor or employer, addressing the student's likelihood of academic success in engineering and professional motivation and success upon graduation, and a second letter from a counselor, clergy, or other professional (could also be a teacher or an employer) specifically addressing the student's professionalism and character;

- Motivation, based on the personal reflection statement, addressing the applicant's motive and commitment to obtain a degree in engineering and join the engineering workforce or continue in graduate studies.

Students apply for the scholarship according to university-established timelines. Applicants are first screened by the University's Student Financial Services to determine financial eligibility. The ECASE Selection committee reviews financially eligible applicants using the criteria outlined above. Students are be ranked according to their potential for academic success (according to grade point averages; courses completed; and reference letters), professionalism (based on reference letters), motivation (based on personal reflection and reference letters), and need (based on FASFA scores). Once rank ordered, the Committee determines the number of full ($10,000) and partial ($5,000) scholarships to be awarded based on the strength of the candidate pool. Upon approval by Student Financial Services, successful applicants are notified by the Project Director.

Number and Status of ECASE Scholars

We began to award scholarships in the fall of 2008. We awarded seven new scholarships in the 2008-09 academic year, nine new scholarships in 2009-10, and seven new scholarships in 2010-11. No new ECASE (I) scholarships were offered in the fall of 2011; however, existing scholarship continued during this academic year. The status of the award recipients for each academic year is outlined below and summarized in Table 1.

Awards and progress review for the 2008-09 Scholars: Of the seven ECASE Scholars beginning in 2008-09, two graduated in spring 2010 and the remaining five continued to pursue their electrical engineering degree in 2010-11. One of the graduates, a female Native American student, will attend graduate school at the University of Washington in electrical engineering, and the second student is now a Hardware Test Engineer for Apple, Inc. Four of the remaining Scholars continued their scholarships at the $10,000 level, and one dropped to the $5,000 for one quarter due to poor academic performance, but then improved his performance enough to increase his scholarship back to the $10,000 level, resulting in an award of $8,333 for the academic year. Three of these students graduated in spring 2011, and the remaining two are expected to graduate by the end of the 2011-12 academic year. One of the students who graduated is now working full-time at the company that he interned with in the previous summer. His internship project was developed into his senior design team project as well. One of the other graduates completed a post-graduate internship and now has a full-time job as a firmware engineer at another company. The third graduate is completing a post-graduate internship that is expected to turn into a full-time position in three to six months.

Awards and progress review for the 2009-10 Scholars: Nine new ECASE scholarships were offered in 2009-10. After the first year, one student graduated and two students changed majors

Table 1. Number and Status of ECASE Scholars (Summary)

Cohort	Student No.	Scholarship Award (2008-09)	Scholarship Award (2009-10)	Scholarship Award (2010-11)	Scholarship Award (2011-12)	Graduation/Status/ Comments
1 (Scholars Beginning in 2008-09)	1	$10,000	$10,000	-		Spring '10; Grad. School
	2	$10,000	$10,000	-		Spring '10; Engr. in industry
	3	$10,000	$10,000	$10,000		Spring '11; Engr. in industry
	4	$10,000	$10,000	$10,000		Spring '11; Engr. in industry
	5	$10,000	$10,000	$10,000		Spring '11; Extended Internship
	6	$10,000	$10,000	$10,000		Spring '12 (exp.)
	7	$10,000	$8,333	$10,000		Spring '12 (exp.)
2 (Scholars Beginning in 2009-10)	1		$10,000	-		Spring '11; Engr. in industry
	2		$10,000	-		Changed Majors
	3		$10,000	-		Changed Majors
	4		$10,000	$10,000	$10,000	
	5		$10,000	$10,000	$10,000	
	6		$10,000	$10,000	$10,000	
	7		$10,000	$10,000	$5,000	Reduced due to poor academic performance
	8		$10,000	$10,000	-	Not full time
	9		$5,000	$5,000	-	Terminated due to poor academic performance
3 (Scholars Beginning in 2010-11)	1			$10,000	$10,000	
	2			$10,000	$10,000	
	3			$10,000	$10,000	
	4			$10,000	$10,000	
	5			$10,000	-	Not full time
	6			$10,000	-	Changed Majors
	7			$10,000	$5,000	Reduced due to poor academic performance

to computer science. The student who graduated is now working for a major company as an Airplane Maintenance Engineer. All six of the remaining Scholars continued in the electrical engineering program in 2010-11 and continued their scholarships at the same level (five at the $10,000 level and one at the $5,000 level). Four of these students completed internships in the following summer and continue to work for the company they interned at in their senior year. All

of these Scholars underwent review in the spring of 2011 to determine eligibility for the 2011-12 academic year. Three of the six were offered scholarships at the same ($10,000) level, one student's scholarship offer was dropped to $5,000 and another's scholarship was terminated (from the $5,000 level) due to poor academic performance. The sixth student was not offered a scholarship because he is not full-time student in his senior year (he is working full time with only a few classes to finish to complete his degree).

Awards and Review for 2010-11 Scholars: Seven students were offered full ECASE scholarships in the 2010-11 academic year. All were reviewed in the spring of 2011, and five scholarships were offered for the 2011-12 year. One of the original seven's scholarship was terminated because he will not be a full--time student in 2011-12, but he is expected to graduate in spring 2012. He is working full time for an engineering company with only a few classes to go to complete his degree. Another student completed an internship in the summer of 2011, and is expected to graduate in spring 2012. A third student's scholarship was terminated because he changed majors. A fourth student's scholarship was reduced from the full ($10,000) level to the partial ($5,000) level in 2011-12 due to poor academic performance. The student has the opportunity to increase his scholarship back to the full level by improving his performance.

Efforts to Increase Diversity

Personal contacts were made at five local community colleges to advertise the ECASE scholarship program to potential applicants. In addition, our Project Coordinator, through her part-time work as a Transfer Admissions Counselor in the Office of Undergraduate Admissions, regularly visited many of the 18 community colleges around the local extended region to recruit transfer students. During these visits, she encouraged qualified prospective ECASE applicants to apply for the scholarship and delivered marketing materials to each Transfer Advising Office. Also, one of our engineering faculty members regularly visited one of the colleges to present material on the program in a freshman engineering class.

We have also made efforts to strengthen contacts with other S-STEM awardees, including two programs at local community colleges and as well as a program in a community college with a diverse student body in a nearby state. The lead engineering faculty member from one of the local community colleges has advised five students to apply to our program. All of these Scholars received S-STEM awards while they were in community college. It should be noted that this institution is the most diverse community college in our state, with the majority of students with significant financial need. Four of the five ECASE Scholars from this institution are students from ethnic minority backgrounds.

Efforts to Maintain Retention Levels

Our ECASE student support programs were developed to encourage students to continue their studies in the electrical engineering program. Specific activities are outlined below.

- **ECASE Faculty Mentors:** We assigned each student an ECASE Faculty Mentor, and all engineering students also have a faculty advisor. Since the roles overlap, in practice, the advisor has also served as the mentor. We encourage faculty mentor/advisors to meet with ECASE Scholars regularly as needed. In addition, the engineering department has weekly faculty meetings, and any issues regarding specific students are discussed. Due to our small size, we are able to identify potential problems with our Scholars early on and then work quickly to address them. The frequency of meetings between mentor and Scholar varies depending on the needs of the student. In one case, the faculty advisor/mentor met with her ECASE advisee on a weekly basis, and in other cases, they may meet once a term. In most cases, advisor/mentors meet with their students two or three times during the term.

- **ECASE Industrial Mentors:** Each of the ECASE Scholars was assigned an industry mentor. The aim for our industrial mentors is to help the Scholars better understand and become connected to the engineering profession as well as provide an industrial viewpoint for the students as they search for internships or jobs after graduation. Our mentors come primarily from our Industrial Advisory Board, and many of them are alumni of our engineering program. Our Advisory Board meets three times a year, and the members are very familiar with and dedicated to the electrical engineering program. Furthermore, Board members often hire our students as interns or as full--time employees after graduation. Industrial mentors agree to meet personally with their designated ECASE Scholar at least once per year and interact with them via phone or e-mail at least twice per year.

- **ECASE Study Hall:** An ECASE Study Hall provided free tutoring for students on a weekly basis. It was staffed by a senior engineering student-tutor funded by the grant. Scholars were encouraged to go to the Study Hall to work on homework and ask questions of the tutor as needed. Our aim here was not only to provide academic support, but peer support among the students. Snacks were also provided.

- **ECASE Social Functions:** In an effort to engage our Scholars to become more connected to our engineering community, we initiated an ECASE Scholar Welcome To/Welcome Back social function in fall of 2010. The objective was to connect first-year ECASE Scholars with returning Scholars. We asked each of the returning Scholars to share their best tips with the new Scholars to ensure a successful transition into the engineering program. The returning Scholars took this request to heart and provided valuable feedback to the students. Several commented on the need to seek out their professors to ask questions and on the need to be organized. This helped reinforce our premise that transfer students are more reluctant to connect with the faculty than their peers who entered as freshmen. This event also served to introduce the ECASE Scholars in different classes to each other. We also sponsored Meet & Greet events in the hour before our Industrial Advisory Board meetings to provide a time for our industrial mentors and mentees to meet and talk with each other. All events were funded through the ECASE grant.

- **Participation in Meetings and Conferences:** In 2010-11 alone, thirteen ECASE Scholars attended professional conferences in 2010-11 with support from the ECASE grant. Two Scholars attended the 2010 IEEE Workshop on Spoken Language Technology, two others went to the 2011 IEEE Digital Signal Processing (DSP) Workshop, and one went to the 2011 IEEE Consumer Communications and Networking Conference. Six Scholars went together to the 2011 Conference on Innovative Smart Grid Technologies in Anaheim, and the last two Scholars went to the 2011 IEEE PES Power Systems Conference & Exhibition. Students were given a choice of which conference they wanted to attend, but were encouraged to attend those within the region. The students were responsible for making up any missed work while they were gone.

  In addition, eight Scholars presented their junior or senior design projects at our university's Undergraduate Research Conference. One team, including one ECASE Scholar, won first place at the Conference for their poster presentation. One ECASE Scholar, along with two other teammates and three business students, competed in our university's Social Venture Competition with the senior design project, "Spektrum Pure-Pump." The competition is designed to encourage students to develop projects that can make a difference in the world. The Spektrum team was narrowly edged out by a team from another major university for the grand prize, placing as the runner-up and winner of the Pioneer Prize presented by Pioneer Human Services.

Efforts to Institutionalize our Focus on Community College Transfer Students

In 2008-09 we initiated a direct admission policy into the electrical engineering department for qualified transfer students, and have continued to directly admit students since 2009-10. The direct admission policy allows transfer students to be directly admitted into the major when they are admitted to the university. Eight other academic departments agreed to be a part of this direct admission program and have been reviewing transfer students for direct admission for the past two years. Engineering continues to be one of the most active partners in this effort. Five of the seven Scholars beginning in the 2010-11 academic year were directly admitted in to the electrical engineering program through this agreement.

In addition to our direct contacts with community colleges with S-STEM programs, we have also been involved our state's Council for Engineering and Related Technical Education. This is a voluntary organization of post-secondary educational institutions within the state who are involved with some portion of the total spectrum of engineering and engineering-related technical education. The Council has great participation from community colleges throughout the state, so participation in this group has enabled better communication with faculty from these institutions.

Lessons Learned

Providing Scholarships: All scholarships were awarded on the basis of academic talent and preparation, financial need, and a commitment to pursue a degree in electrical engineering. As expected, the strongest students entering the program continued to be the strongest students continuing in the program. The few students that either dropped out of the program due to a change in major or had their scholarships reduced due to poor academic performance exhibited the lowest academic promise at the onset of the program. Our selection process, based on a numerical rating of academic promise, academic preparation (at a community college), financial need, and a commitment to pursue electrical engineering based on a personal statement and letters of support has proven to be fairly accurate on predicting the success of a student in our program. The inclusion of partial scholarships at the $5,000 level has been a useful tool for borderline students. The ability to either raise a student from the $5,000 level to the $10,000 level with improved academic performance or to lower $10,000 scholarship to the $5,000 level for lower academic performance has been a good incentive for our students to improve their study habits.

Each student was reviewed by a review committee each spring on an annual basis to determine if they qualified for the award the following year. After the review, the Program Director met with each student individually to discuss the outcome of the review. This worked quite well, as it provided an opportunity for the students to voice any problems and concerns. However, by only meeting in the spring, issues with new students can be overlooked; therefore it is recommended that new students have the opportunity to meet with the Director during their first year.

While not a distinct part of our ECASE program, our departments requirement that all students complete an internship between their junior and senior year has proven to provide very positive employment opportunities for our Scholars, with many of them having full time job offers in engineering positions well before graduation.

Increasing Diversity: The ECASE program has significantly increased the diversity of our engineering student body. Thirty-nine percent of our ECASE Scholars are from U.S. ethnic minority backgrounds. This compares with a campus average of 33 percent for transfer students and 20 percent for the overall student population. Furthermore, six Scholars were first generation college students, and four students began the program over the age of 30. We attribute our success at attracting students from diverse backgrounds to 1) focusing our efforts on community college students; 2) seeking and maintaining close connections to local community colleges with diverse populations; and 3) maintaining a cohort among the students with a common background (i.e., transfer students and grouped by year so that they are in many of the same classes). Community college transfer students in particular are a potentially untapped resource for the technical needs of our nation[1]. Since community colleges typically offer a quality education at a much reduced cost compared with four-year public or private institutions, they tend to attract

students with financial needs[2] – a requirement for this program. For example the two largest public institutions in our state have tuition rates 2.5 times greater than local community colleges, and tuition increases at colleges and universities across the U.S. have grown rapidly for the past two decades[3]. Enrollment data support this idea: approximately 43 percent of underrepresented minority male student attend public 2-year

Figure 1. Matriculated UG percentages of U.S. ethnic minority students (based on Fall 2009 census data from Seattle Pacific University)

institutions, while approximately 33 percent attend 4-year public institutions; these data are reversed for white male students[4]. Furthermore, our university's enrollment data (shown in Figure 1) show that incoming transfer students are more likely to be from a diverse background. Thus, by focusing on transfer students, we attract students with high financial need who are more likely to be from a diverse background.
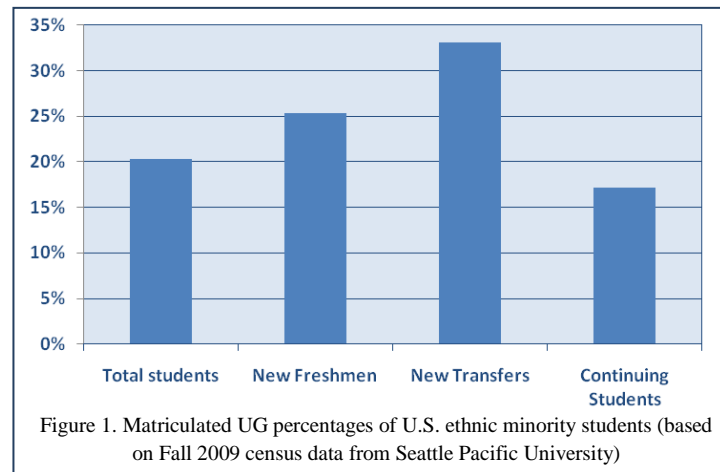
Our personal connections with local community colleges with diverse student bodies have been very beneficial in student recruitment. Our university is small, with small class sizes, offering opportunities for faculty to interact with students on a frequent basis. Our colleagues at some of the local community colleges know this and have encouraged particular students to pursue our program because they know that the student will most likely do better with the increase attention than they would at a larger institution. These students have been very successful in making the transition from the two-year to the four-year institution.

Finally, it has been shown that the most successful S-STEM scholarship projects involve a cohort of students who in some way naturally associate[5]. This holds true with our Scholars as well. All of our ECASE Scholars are transfer students and within a single major – electrical engineering; some are even from the same community college. As a result, our Scholars provide each other with a very supportive environment as a result of these commonalities.

Maintaining Retention Levels: The lessons learned from each of our student support programs aimed at encouraging students to continue their studies in the electrical engineering program are outlined below.

- **ECASE Faculty Mentors:** In practice, our formal ECASE faulty mentor program was not very effective due to the variability of commitment by both students and faculty. However, our weekly faculty meetings, where we spend a few minutes identifying any students with specific issues in particular classes, has proved to be more beneficial at catching students in.

Trends are easy to spot in this way, so that students can be contacted early on if problems exist.

- **ECASE Industrial Mentors:** Our success with the Industrial Mentors continues to be varied and has been highly dependent on the attitude and commitment of the ECASE Scholar mentee. As a result, we are making changes in the Industrial Mentor program for 2011-12. First, we will only offer Mentors to second-year students as we found that the first-year students were focused on adjusting to the new environment and therefore received limited benefit from the mentoring experience. Second, it will be a volunteer commitment from the students. Students will sign up for a mentor only if they want to. If they do, they will have to commit to meet with the mentor or they will not be allowed to participate in the program. This is an effort of empowering the students to be more responsible for their futures, and this approach has worked well in other campus-wide mentoring programs.

- **ECASE Study Hall:** The study hall was not successful due to lack of Scholar interest and was discontinued as a result. We still believe that a place for students is needed and that some students would benefit greatly from tutoring. Therefore, we created a new study group – open to any student who feels a need for additional help in their classes. The group is called HUDDLE. Instead of organizing a study hall, we are focusing our efforts on facilitating the organic development of study groups among the students themselves. We believe that student-motivated study groups will be far more effective for the students than our previous study hall.

- **ECASE Social Functions:** The ECASE Social functions, particularly the Welcome To/Welcome Back event in the fall, have been beneficial to the students. The fall event has provided an opportunity for ECASE Scholars from different classes to get to know each other. By asking the senior students to share their experiences with the incoming students, some of senior students have shown a continued interest in the welfare of the newer Scholars. In all, these events have helped students to bond together.

- **Participation in Meetings and Conferences:** Providing opportunities for students to attend professional conferences and present their work in local conferences has been very beneficial in the professional development of our Scholars. Attending professional conferences has vastly opened the students' eyes as to what possibilities are available in different sub-disciplines of electrical engineering. While the overall experiences were generally positive, we did find that sending new students to conferences was not beneficial. Students gained the most benefit in their second year – before they completed their internships. Providing opportunities for students to present their work at local conferences has increased their confidence level and their ability to effectively communicate.

Institutionalization of our Focus on Community College Transfer Students: The direct transfer agreement is very important factor in attracting students into the program. All of those who have been directly admitted have been successful, and we will continue to use this to attract qualified students into the program. Furthermore, involvement in the Council for Engineering and Related Technical Education has provided us opportunities for personal contacts with community college faculty and better insight on what community college students need. Overall personal contact with community college faculty has been very beneficial.

Conclusions

Our ECASE Scholarship program has been successful in awarding scholarships to qualified students. Some of the key lessons learned through the implementation of this program include:

- A quantitative assessment of incoming students based on financial need, academic talent, academic preparation, and commitment to pursue their degree has been a good at predicting student success.
- Focusing on community college students provides a common cohort and opportunities to increase diversity.
- Having our ECASE part-time staff support person also work part time in the University's admissions office provides for an excellent portal into the university's admissions process and recruiting efforts.
- Student support programs must have significant student buy-in to be successful.
- Student participation in professional meetings provides beneficial professional development opportunities.
- Personal connections with community college faculty are critical in building long term relationships with these institutions.
- Direct transfer agreements with community colleges are useful in attracting qualified students into our program.

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