

Industrial and Mechanical Engineering Scholars with Scholarships, Career Mentoring, Outreach and Advisement, Professional Societies and Engineering Learning Community (SCOPE) S-STEM Program

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Industrial and Mechanical Engineering Scholars with Scholarships, Career Mentoring, Outreach and Advisement, Professional Societies and Engineering Learning Community (SCOPE) S-STEM Program

Abstract

In 2015, Lamar University (LU) at Beaumont, Texas was awarded an NSF S-STEM grant titled “Industrial and Mechanical Engineering Scholars with Scholarships, Career Mentoring, Outreach and Advisement, Professional Societies and Engineering Learning Community (SCOPE) S-STEM Program.” The goal of the project is to recruit and retain more Industrial Engineering (IE) and Mechanical Engineering (ME) students by providing scholarship funding. This project provides scholarships to academically talented and financially needy IE or ME students to help them complete their Bachelor’s degree. The amount of eligible support was determined based on FAFSA applications through the assistance of the LU Financial Aid Office. The scholarships are complemented by extensive academic support. The project integrates IE and ME scholars with services including Scholarships, Career Mentoring, Outreach and Advisement, Professional Societies and Engineering Learning Community (SCOPE). As such, the students are called SCOPE Scholars in this project. This program will target students from sophomore to senior years and guide them through their degree completion. In fall 2015, the first cohort of 10 SCOPE Scholars were recruited with about \$60K of scholarships distributed. At the beginning of fall 2015, a SCOPE orientation was held to explain the expectation of the SCOPE Scholars. LU President, Provost, Dean of Graduate Studies, Dean of Engineering, Chair of IE (Co-PI), Chair of ME (Co-PI), Director of Undergraduate Research, Coordinator of Learning Communities, Senior Director of Co-op and Outreach, and Director of Engineering Marketing attended the orientation. They either addressed the scholars or discussed the relevant academic support available from the university. The scholars are mentored at least twice a semester. During the semesters, they actively participate in extracurricular activities which are assessed using a point-based method. Two undergraduate students were recruited to document their activities and serve as the coordinators. The scholars complete two surveys each semester, one at the beginning and one near the end of semester. Some scholars are randomly selected for one-on-one interviews with the assessment specialist. After one year, all the scholars were able to maintain 3.0+ GPA and meet the requirement for extracurricular and mentoring activities. One scholar graduated in summer 2016 and one scholar received a Co-op position. The second cohort of 9 SCOPE Scholars have been recruited in fall 2016 and they joined the current scholars.

1. Introduction

In 2015, Lamar University (LU) at Beaumont, Texas was awarded an NSF S-STEM grant titled “Industrial and Mechanical Engineering Scholars with Scholarships, Career Mentoring, Outreach and Advisement, Professional Societies and Engineering Learning Community (SCOPE) S-STEM Program”. The goal of the project is to recruit and retain more Industrial Engineering (IE)

and Mechanical Engineering (ME) students at LU. Besides scholarship, SCOPE Scholars are supported with career mentoring, outreach and advisement, professional societies, learning community activities throughout the program^{1,2,3,4,5}.

The project is designed to address not only the intrinsic difficulties of degree completion when faced with financial instability, but also the well-known difficulties that pre-engineering students experience as they decide upon a career in an engineering discipline. The project assists in the recruitment and retention of low-income, academically talented IE and ME students to advanced study and/or careers in STEM. Project results will determine the effectiveness of continuous intervention in retaining low income engineering students and will contribute to the development of the best practices for retaining low income, talented engineering students.

The rest of the paper is organized as follows. Section 2 discusses the scholar recruitment and scholarship distribution. Section 3 discusses the scholar activities. Section 4 discusses the scholarship assessment for the first year. Section 5 has the conclusion for the paper.

2. Scholar Recruitment and Scholarship Distribution

In fall 2015, the first cohort of 10 SCOPE Scholars were recruited with about \$60K of scholarships distributed. The scholar selection criteria are:

- 1) U.S. Citizen, Permanent Resident, U.S. National or aliens admitted as refugees;
- 2) Enrolled full time for each long semester in which a scholarship is received;
- 3) Incoming sophomore, junior or senior; sophomore has priority;
- 4) Have completed Calculus I, Calculus II and Calculus-based Physics I with minimum grades of B;
- 5) Have a minimum LU GPA of 3.0 (cumulative and within the major), or otherwise demonstrate successful progress towards and commitment to the completion of IE/ME degree;
- 6) Have declared Industrial Engineering or Mechanical Engineering as the major;
- 7) Demonstrate financial need as defined by the US Department of Education rules for need-based federal financial aid - Free Application for Federal Student Aid (FAFSA).

Applications were submitted through a scholarship application website set up by the Director of Engineering Marketing. The project teams reviewed all applications and selected 10 students as the first cohort of scholars. In the first cohort of 10 scholars, there are 1 IE and 9 ME students; there are 1 female and 9 male students; there are 1 African American, 1 Asian, 4 Hispanic, and 4 White. Altogether 50% of them belong to an underrepresented group (female and/or minority).

Scholarships are distributed in each long semester through the Financial Aid Office. Each scholarship distribution is a maximum of \$5,000 per semester, depending on the students' expected family contribution and the amount of the institution's cost of attendance. On average, the first cohort of students received \$6,218.20 in the first year.

At the end of the first year, one Hispanic scholar graduated and another Hispanic scholar started working on a co-op from fall 2016. All the other scholars remain to be eligible for the scholarship.

The second cohort of 9 SCOPE Scholars have been recruited in fall 2016 and they joined the current scholars. Among the 9 new scholars, there are 4 female and 5 male students; there are 2 African American, 1 Asian, 1 Hispanic and 5 White. Altogether 66% of them belong to an underrepresented group.

Altogether in fall 2016, 17 scholars are active in the program. In spring 2017, one African American female scholar starts to work on a co-op.

3. Scholar Activities

At the beginning of fall 2015, an SCOPE orientation was held to explain the expectation from the SCOPE Scholars. LU President, Provost, Dean of Graduate Studies, Dean of Engineering, Chair of IE (Co-PI), Chair of ME (Co-PI), Director of Undergraduate Research, Coordinator of Learning Communities, Senior Director of Co-op and Outreach, and Director of Engineering Marketing attended the orientation. They either addressed the scholars or discussed the relevant academic support available from the university. The scholars are mentored at least twice a semester. During the semesters, they actively participate in extracurricular activities which are assessed based on a point-based method. Two undergraduate students, one IE and one ME, were recruited to document their activities and serve as the coordinators. The two student assistants are not SCOPE Scholars.

At the beginning of fall 2016, another SCOPE orientation was held with similar activities. One student assistant graduated and was replaced by another student.

According to the proposed plan, SCOPE Scholars are expected to receive enhanced mentoring and participate extracurricular activities. During the orientation, the scholars are given a list of elective activities. The activities are categorized into five categories as planned in our original proposal. Each category has one required activity and several optional activity. Each optional activity is given certain point value. The categories are:

1) Career mentoring

Scholars are required to be matched with mentors for career mentoring. Optional activities include co-op consultation and career center consultation.

2) Outreach and advisement

Scholars are required to meet the mentor to discuss class schedules, grades, academic needs, etc. Scholars are mentored 2 to 3 times per semester. Optional activities include honors contract, undergraduate research, academic/industrial seminars, conferences, publications and presentations, industrial tours, etc. Some new optional activities were added after year one's project execution as the project team learned a few new activities.

In the first year, 1 scholar received a Summer Undergraduate Research Fellowship Grant to work on a summer project titled "Modified Power Plant Solid Waste (Fly Ash) for Absorption of CO₂".

In fall 2016, more undergraduate research activities are observed from SCOPE Scholars. Three SCOPE scholars and one SCOPE assistant received undergraduate research grants from the Office of Undergraduate Research.

3) Professional certification and professional societies

Scholars must be members of either Institute of Industrial and Systems Engineer (IISE) or American Society of Mechanical Engineer (ASME). Optional activities include professional certification preparation course, six sigma / lean manufacturing green belt training, attend professional society meeting, or lead professional societies.

In fall 2016, 1 scholar attended Six Sigma training.

4) Engineering learning community

Scholars must be a member of residential learning community (LC) if living in dorms. Optional activities include being a member of any LC, and mentor students in other LC, especially freshmen.

In reality, most scholars do not live on campus and thus it was really hard to promote residential learning community. A few scholars managed to help freshmen LC organized by the LU STAR services. A few scholars formed study groups to help with each other in common courses.

5) Activities to support SCOPE recruiting and assessment

Scholars are required to respond to online surveys twice per semester, organized by the project assessment specialist. Some scholars are randomly selected for face-to-face interview by the assessment specialist. Optional activities include new scholar recruiting and information seminars.

A Facebook page has been established for the SCOPE program to disseminate the activities information⁶. In summary, all student activities are documented with proof and recorded in Excel sheet. The content of these activities are surprisingly diversified and creative.

4. Scholarship Program Assessment

a. Scholar Performance

After one year, all the scholars are able to maintain 3.0+ GPA and meet the requirement for extracurricular and mentoring activities. One scholar graduated in summer 2016 and one scholar received a Co-op position. Once a scholar receives a Co-op position, he/she is no longer eligible for SCOPE scholarship due to FAFSA requirement. A Co-op scholar can still keep the SCOPE Scholar title, and once he/she comes back to full time student status, he/she will still be eligible for scholarship.

In the current 2016~2017 academic year, all the scholars maintained 3.0+ GPA and met requirements for extracurricular and mentoring activities by the end of Fall 2016. One scholar received a Co-op position in spring 2017.

b. Scholar Survey Results

To see the effectiveness and its impact of the scholarship program, we have conducted pre and post assessment, which includes goal orientation, scholars’ academic and social activities on campus as well as their perceptions regarding their experiences. A total of 10 students (40% Hispanic, 40% White/Caucasian, 10% African American, and 10% Asian/Pacific Islander) were comprised of three sophomores, five juniors and two seniors in the College of Engineering. A majority of the scholars were male (90%), and their mean age was 22.7 (SD = 4.5; range 19-34). Three students indicated that they were the first in the family to attend college. Regarding employment status, three students stated that they were employed, and two of them said their employment was not academically relevant in nature.

When asked for their main reason to apply for the scholarship, 70% of them said financial support for their study, 20% of them said opportunities for meeting with others, and 10% said mentorship. Upon the onset of the project, the majority of scholars (80%) indicated that they knew fewer than five of their SCOPE scholar peers (see Table 1). By the end of the first semester, 50% of the scholars said that they felt comfortable interacting with most of their peers. As means of communication, students reported that in addition to interacting with one another in person, they also used social media website and mobile app. More detailed information regarding types of social activities and scholars’ satisfaction is in the next section through interview data.

Table 1. Comparisons of SCOPE Scholars’ Social Activities

Year	# of scholars they did social activities together		# of peers they feel comfortable interacting with	
	With 0-3 peers	With 4 or more peers	0-3 peers	4 or more peers
2015	7	2	6	3
2016	5	5	1	9

Regarding academic activities, 70% of students reported that their academic activities on campus has increased as a result of SCOPE scholarship, and the remaining 30% said that it has not changed because they were already actively involved in various activities prior to becoming scholars.

c. Scholar Interview Results

Some scholars were invited for a one-on-one interview with the assessment specialist. All interviews were recorded and transcribed for further analyses. Regarding the impact the scholarship program, students seemed to be more comfortable interacting with their peers, faculty members and with research assistants. In some cases, their scholarship activities even

prompted them to interact with people they did not know before. Below are interview quotes from students who talked about their campus life change by comparing before and after the SCOPE scholar experience:

... I meet more friends, more people, some people I don't even know when I go to this last meeting in the Dining Hall. I know some people; some people I don't even know before and I make friends with them.

For a long time, I was very, as you could say, socially inept. I didn't really talk to people unless they were family or really close friends who I've known for a very long time. So, I was starting to come out of my shell a little bit. Which you know, better late than never I guess.

... Let me tell you, I don't even have a good connection with my professor, like a strong connection. You know what, we just go to class and then he asks us some questions and then we go home. I only do the homework. As a scholar, I have more time to talk with professor to discuss my grade, my resume, and my training, how to study, and where. I had discussed with [scholarship faculty mentors] even though I didn't know them before. I have the opportunity to talk to them. They're nice. They help me.

When asked whether all of the campus life involvement would have been happened even without the SCOPE scholarship program, one student said, "Not to the extent that I did. Maybe a little. I would've had some interest on certain things, but I wouldn't. No, I don't think I would've done as much as I did this semester." In addition to the increased social and academic activities on campus, prompting students to think about career paths. Below is an example interview quote:

[SCOPE activity] gives me a feeling of what kind of career path I want or what kinds of career path are available. It helps me attract with people I wouldn't normally attract, and it helps me have all these connections if I need help with a class, or if someone needs help with something and I can help them with. I think there's a big benefit with going to all these things we're required to go to.

One of the notable findings of this study is the fact that students benefit from organized social and academic activities. In many cases, these campus activities are assumed to naturally occur by college students as they are mature enough to make decisions on matters or they are perceived and treated as independent individuals who like to take initiatives for their actions. Interestingly, students expressed their desires not just to be academically stimulated, but also to be socially stimulated. Also, students said that some organized plans or structures could benefit them to be more involved in their campus life. Below are some example interview quotes:

The main reason [I applied for the SCOPE scholarship] was to become more involved in the Engineering department. My first year as a freshman, I wasn't really that involved. So, I decided to apply.

[If I become SCOPE scholar], then I have something that motivates me, something that is a requirement, a threshold that I need to achieve. I figure that helps me in the long run because I get to experience being in groups, socializing with people I wouldn't otherwise. It just helps me get out there, so I feel like this is not a personal thing. Or it is personal, It's on a personal level where I can socialize with other people type of thing.

5. Lesson Learned

There are many lessons learned from the cohort of the scholars during one academic year. A few lessons are as follows:

- 1) Good student assistants are critical to the success of the student activities. Our scholars perform well academically, but they are typically not active in social activities. Our student assistants are very helpful as coordinators. They use social network to group scholars together and keep in touch with them through instant messengers. Through icebreaking activities, scholars become more accustomed to more activities. Student assistants also provide faculty mentors valuable feedback. For example, we revised our point-based activities based on the feedback from the student assistants.
- 2) Faculty mentors need to lead and meet scholars in activities. Our recruited scholars are good academically but many students shy away from extracurricular activities. For this reason, it is important for faculty mentors to disseminate activity information and lead them to these activities. Once scholars joined these activities a few times, they started to realize the importance of meeting people, and to understand why they need to study hard for their future career.
- 3) An engineering learning community (LC) is hard to organize when most students are living off campus. At the proposal writing, we assumed most undergraduate students would live on campus, and we would move all scholarship students into one dormitory building. In reality, most students live off campus. For those living on campus, they live in different buildings and they prefer to stay where they are for various reasons, e.g., they like staying with their current roommates. Therefore, we can only encourage smaller study groups and ask them to support freshmen LC if possible.
- 4) We used a point-based system to quantify student activities. In the first year, we required 10 points for sophomore, 15 for junior, and 20 for senior. After year one's project execution, we realized that sophomores actually have more time to participate in extracurricular activities and students should be encourage to learn out of classroom to become more motivated. Therefore, the point requirement is adjusted to 15 points for all sophomore, junior and senior students. We also placed more points on some more important activities such as undergraduate research, professional certificate training, and student professional organization leadership.

6. Conclusion

The 5-year project started in fall 2015 and is currently in its second year of operation. The project has been running smoothly with all scholars meeting criteria and requirements. The project is expected to have a sustained impact on LU, Southeast Texas and the Gulf Coast. The SCOPE support is especially critical to outreach in the large surrounding school districts whose minority populations averages 72.5%, and 64.8% of students are considered to be economically disadvantaged. Our scholarship program will strengthen its role in increasing the number of well-educated and skilled engineers from diverse and underserved backgrounds.

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