Helping Students Get More than Their Money from an Engineering Scholarship Program

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***Abstract* — While scholarships can serve as an important source of financial support and motivation for students attending university, they do not guarantee that recipients will graduate on time or graduate at all. Personal, health, and financial issues can conspire to overwhelm students, who then may stumble academically and thus lose their scholarships. To maximize the impact of scholarships, the NSF-funded S-STEM Engineering Leadership Pathway Scholars (ELPS) program provides support and activities to motivate and prepare upper division students to complete B.S. engineering degrees with the attitudes, knowledge, and skills to be leaders in the 21st century workforce and to pursue graduate degrees. Dedicated mentors and frequent interactions with industry professionals have been key to the success of the program. The average graduation rates and time to degree for these students are better than those of the university. Furthermore, ELPS recipients participated at higher rates in research and other professional development programs than typical students at San José State University. This innovative practice work-in-progress paper presents results of a post-scholarship survey and follow-on interviews, which indicate that the high-impact practices embedded in ELPS, in particular the mentoring, have had a positive impact on recipients' leadership skills and attitudes, their career paths, and their overall university experience.**

Keywords—scholarships, mentor, leadership, S-STEM

I. Introduction

In the early 2000s the San José State University (SJSU) College of Engineering made a concerted effort to attract scholarship funding from private and public sources to support success of its students, many of whom have high financial need, are underrepresented in STEM, and are first generation college students. Assessment of recipients' academic performance and progress to degree revealed that awarding scholarships was only part of the formula for meeting student needs. Bright, motivated students were losing their scholarships due to low grades, often as a result of issues unrelated to their academic potential such as family responsibilities, health concerns, housing insecurity, or lack of knowledge of university policies. In an attempt to better serve the scholarship students, the college drew on evidence in the literature on student success practices [1], particularly mentoring [2, 3, 4] and leadership development [5, 6, 7], to revise and augment its program. Before creating this support model, 20% to 30% of scholars annually would not meet continued eligibility requirements and would lose their scholarships.

The resulting Engineering Leadership Pathways Scholars (ELPS) program incorporated mentoring, community building, and co-curricular activities focused on leadership and professional development that have generated positive student outcomes. ELPS was funded by the National Science Foundation (NSF) through two consecutive grants from the Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM) program. The grant will end in 2019 and the college is pursuing new sources of funding. The goals of the NSF S-STEM program are to increase the number of low-income academically talented students completing STEM degrees while simultaneously generating knowledge about curricular and co-curricular activities that support student success and increase graduation rates. The NSF S-STEM guidelines require that all activities be optional for scholarship recipients, which has caused uneven participation from student to student in ELPS activities. Program management, the selection process, and program activities are described in more detail in [8]. This paper documents lessons learned from eight years of management of the program.

II. ELPS Program Elements

The ELPS program goals are as follows:

- Effectively support students so that they graduate on time, with the technical background, performance record, and motivation needed to pursue graduate degrees or enter the workforce.
- Create and institutionalize activities that promote and reinforce attitudes and skills essential to engineering and personal leadership through leadership development opportunities.
- Develop the scholarship recipients as a community of learners who support each other's individual and common goals.

The third goal has been the hardest to achieve, in part due to the NSF requirement that activities be optional. Students are extremely busy with school, work and family, and most commute to campus (many from great distances). Although the organizers try to maximize attendance by varying the activity times and days, occasionally only a few students attend.

Ten to twelve new scholarships are awarded each year to students entering their junior year, though in a few cases scholarships have been awarded to sophomores. Each student is awarded $6000 per year for up to three years, which essentially covers only annual tuition. About half of the recipients are transfer students. In addition to demonstrating

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financial need through the Free Application for Federal Student Aid (FAFSA®), recipients are required to have an overall grade point average of 3.0 or above and complete several short essays about their leadership goals, attitudes and activities. Recipients must be full-time students and U.S. citizens or permanent residents. In interviews conducted with ELPS alumni, several former students summarized the impact of the financial support in this way: *"[the scholarship] helped me focus on school*." One respondent to a survey of ELPS alumni noted: "*After working multiple jobs the year before being an ELPS scholar, I finally had more time to focus on research and courses, and explore professional development opportunities and get feedback on those opportunities from ELPS mentors and professors, like submitting for conferences, summer research opportunities, other scholarships, graduate school applications, job searching, and how to mold myself as a leader in the capacities I was interested in, like in research labs.*"

Many scholarship recipients do not have access at home to role models with college experience who they can ask for help when problems arise or who can assist accessing resources and exploring the many opportunities that are available to college students. Informally, continuing scholars are available to serve as peer role models for the newcomers. More formally, a team of faculty mentors meets regularly with ELPS recipients in small group discussions. Mentors are encouraged to contact their assigned students periodically to touch bases and remind these students that they have a faculty member to turn to. Mentors often serve as references for other scholarships and help students identify and access career and other professional development opportunities. One alumni recalled in an interview: "*ELPS really helped me make connections [with other students, faculty and industry representatives]. When there are people mentoring you – you start feeling… I can do this*." The secret sauce for supporting these students requires mentoring, one-on-one interaction, tracking, and intervention. This in turn requires an extensive time commitment. As reported in another S-STEM program, paid staff is needed for the program to reach its full potential [9]. Dedicated paid support would have allowed the ELPS program to do much more with developing activities, engaging alumni, following up with potential speakers, etc.

Intrusive monitoring and intervention are essential elements in supporting the students' ongoing success and eligibility for the program. The lead mentor monitors the grades each semester and contacts any student who appears to be having trouble in one or more courses. The lead mentor discusses potential causes of any poor academic performance and helps each student identify strategies and resources to make improvements. This can mean connecting a student with tutors (which the ELPS program pays for), counselors, financial aid, housing, and many other services on campus. Based on input from multiple focus groups over several years as well as open ended comments on a summative survey, participating students are very appreciative of the opportunity to discuss their challenges with a sympathetic faculty member who wants to help them.

ELPS activities have focused on leadership development with the goal of instilling engineering graduates with skills and attitudes to become leaders from the beginning of their professional careers. Students are encouraged to set annual goals, develop leadership plans, create LinkedIn profiles, complete a Meyers-Briggs Type Indicator® personality survey, and attend at least one, and preferably two, ELPS activities during each semester. Activities include guest lectures, field trips, lunches with peers and faculty, meetings with a career counselor, fun outings to movies or hiking, a scholarship luncheon with industry representatives, and the annual engineering awards banquet. In addition, students are encouraged to participate in the many programs on campus that also develop professional skills and leadership such as the Women in Engineering Conference, the Research Initiative for Scientific Enhancement Program, and student professional organizations such as the National Society of Black Engineers, Engineers without Borders, or the American Society of Mechanical Engineers.

Students are also encouraged to venture beyond the campus and attend monthly meetings of professional organizations or conferences to learn about advances in their fields, network with professionals or present the results of their research. The ELPS program reimburses students for attending these events. Students are encouraged to apply for summer research experiences for undergraduates (REU) or for international programs such as the college's Global Technology Institute in Taiwan.

To support development of a community, all recipients are invited to join the ELPS Facebook page where anyone can post news and photos. The mentors are the most frequent posters to Facebook, but the students often "like" or comment on the posts. Leadership groups were set up in the Canvas Learning Management System to promote engagement among the students with respect to their leadership goals. The concept was only mildly successful, because without paid staff it required too much monitoring from the volunteer mentors.

III. Program Assessment

To date, 83 students have received ELPS funding, of which 58 have graduated, 4 left the program without completing a degree, and 21 are still pursuing their degrees. ELPS graduates have an average GPA of 3.52. Fifteen (15) students have gone on to graduate school, of which 3 are in PhD programs. Students have attended graduate programs at top universities around the country as well as SJSU. Transfer students graduated in an average of 5.9 semesters, with 68% graduating in 3 years or less. In comparison, the 3-year SJSU graduation rate for transfer students varies between 36% and 50%. Native students graduated in an average of 10.1 semesters with 100% graduating in 6 years or less, compared to the university rate of 42%. Review of other S-STEM scholarship programs shows increases in student GPAs, retention rates and graduation rates (though at varying degrees) when mentoring, academic support services, and professional development are provided to students [9, 10, 11, 12, 13]. However, it should be noted that the student populations for these programs are not identical to ELPS, thus a direct comparison is difficult. Furthermore, ELPS focused on outcomes beyond retention and graduation, which were touched on only lightly in most of the studies that were reviewed.

A survey was conducted in spring 2018 to document how the ELPS program contributed to influencing and shaping the careers and other opportunities ELPS participants pursued after completing their baccalaureate degree. Questions explored students' current employment and graduate school attendance, the impact of ELPS on students' college experience and success, professional growth and development, their feelings about a continuing relationship with the college as alumni, and their attitudes and self-confidence. Open ended questions explored the most important gains from ELPS, how ELPS prepared students for their first job, how graduates are involved in the profession, how the program could be improved, if (and how) graduates would like to be engaged with the program or the college in the future, and if they would like to participate in a phone interview.

The survey followed up on previous focus groups administered while ELPS students were still attending college. Previous findings indicated that ELPS helped students maximize their potential by enabling them to leave part-time jobs that prevented them from studying or even getting enough sleep to do well academically. It also helped students pursue internships and research experiences that were relevant to their academic and career advancement, but that may not pay as much as a job in an unrelated field. Importantly, it contributed to helping students set aside time to engage in career-enhancing activities such as attending industry events, getting to know their professors, and researching companies and graduate programs.

IV. What the Students Said

The survey was sent to the 58 program graduates, and 32 responded. Five responses were incomplete, thus the data analysis was performed on the 27 remaining responses. Among the 27 survey respondents, 23 agreed to participate in the phone interviews.

Most survey respondents (81%) felt ELPS helped them be more successful in their academic pursuits (Fig. 1). It is not surprising that 85% of respondents agreed that the scholarship helped them graduate on time. At SJSU, many students attend part time while working 20 to 40 hours per week to support themselves. The scholarship allowed them to work less, permitting them to spend more time studying, which in turn helped them earn higher grades. It also allowed them to enroll in more units, which facilitated earlier graduation.

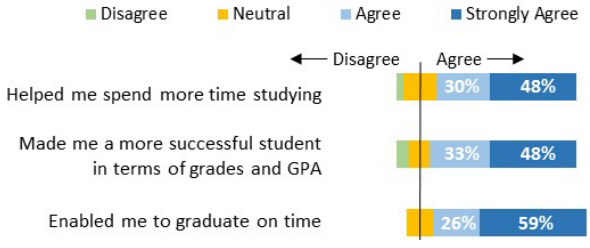

Fig. 1. ELPS helped students be more successful in their studies.

Fig. 2 suggests that the ELPS program largely achieved its goal of creating community; 96% agreed the program helped them meet other students and 96% agreed they felt part of a community. All respondents (100%) indicated that they were able to engage with faculty in ways they would not have otherwise been able to. At a large university many students never really know a faculty member well. ELPS participants met regularly with them, went on field trips and bowling, and could stop by their office whenever they had a question. On the survey one alumni said *"At the ELPS luncheons, I made friends in the program. This helped me expand my idea of other [engineering] majors out there."* Alumni shared that knowing students from other majors helped prepare them to work in team environments with engineers from different disciplines.

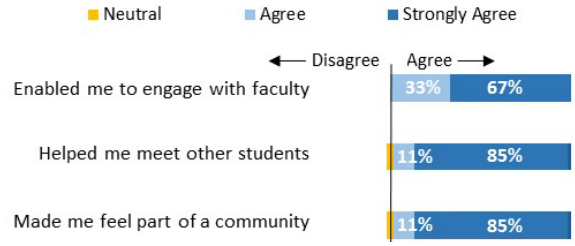

Fig. 2. ELPS helped students engage with faculty and other students, and feel part of a community.

As shown in Fig. 3, ELPS had a positive impact on participants' self-confidence and professional development. Students began to build their professional networks by meeting industry representatives at leadership breakfasts, field trips, guest speaker presentations, the engineering awards banquet, the scholarship luncheon, and sometimes during "munch with the mentors" meetings. One survey respondent said "*By being able to connect with leaders in the engineering profession through ELPS in relaxed settings, it made interviews and talking with engineering managers less frightening and my first job in the industry less intimidating."*

Fig. 3. ELPS helped students explore career options and feel more confident about their ability to succeed.

Engineering curriculum challenges students, and at some point many students doubt their ability to complete the program. Being supported by motivated peers and mentors helped students gain confidence that they could succeed. All survey respondents (100%) indicated that the ELPS made them feel they have the potential to achieve their career choice. As one alumni stated "*It is through programs like ELPS that I was able to build my own self-confidence and*

understand that I too have potential to succeed, even when I failed momentarily." It is noteworthy that several interviewees recounted that their academic and career achievements have inspired friends and family members to see that college and a STEM career are attainable. This outcome shows how the program leverages the NSF investment beyond its impact on the scholarship recipients.

ELPS built its program on developing leadership skills as outlined in Farr et al. [6]. Small group gatherings, leadership breakfasts, readings, and self-reflections focused on goal setting, being intentional, team building, ethics, using power wisely, risk taking, and being a good communicator. Students were strongly encouraged to practice these skills through getting involved with some of the hundreds of opportunities on campus, especially to take on leadership roles in student organizations. As shown in Fig. 4, 96% of students agreed that ELPS helped them engage in activities beyond the classroom and 70% agreed that it increased their interest in research, writing and presenting papers, and attending conferences. At these conferences, where attendance was paid for by ELPS, students were able to learn up-to-date information about advances in their field, practice interacting with professionals and attend student-centered sessions on preparing themselves for their future careers.

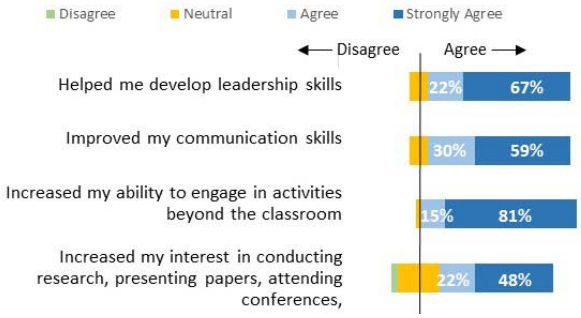

Fig. 4. ELPS helped students develop important professional skills and to explore opportunities beyond the classroom.

To motivate ELPS participants, during field trips, leadership breakfasts, and at other opportunities to meet with industry representatives, the professionals always were asked if they attended graduate school and how graduate school affected their careers. They also were asked about how they weighted graduate education in their hiring and promotion decisions. Numerous students participated in research with university faculty or in summer REU programs where a heavy focus is placed on the steps involved in applying to graduate school. All of these cues and suggestions had a positive influence on students, with 77% of respondents considering applying to graduate school (Fig. 5). An alumnus emphasized this point with this statement, "*ELPS showed me **how** to go to college and, later, not just that I could go to graduate school, but **how** to go to graduate schoo*l." Of the 27 survey respondents, 4 were already in graduate school or had completed graduate degrees, and 13 indicated that it is likely or very likely that they will attend graduate school. For SJSU students, this is well above the norm.

Fig. 5. ELPS had a positive influence on considering graduate school.

The respondents overwhelmingly agreed that ELPS positively contributed to their overall experience as students and that the program increased the likelihood that they will talk positively about the College (Fig. 6). Results in Figs. 3 and 6 are consistent with the APPLES study [14] that reported high levels of educational satisfaction and professional confidence for students engaged with faculty and with extra-curricular experiences as well as significantly exposed to the engineering profession. Alumni are performing innovative research or have found exciting jobs. All are making important contributions, and they are justifiably proud of their achievements. One alumnus noted: "*We are an Innovation Center for Autonomous Driving in Silicon Valley. Being able to develop software in such a ground-breaking field every day is what excites me. We are pioneering the future!*"

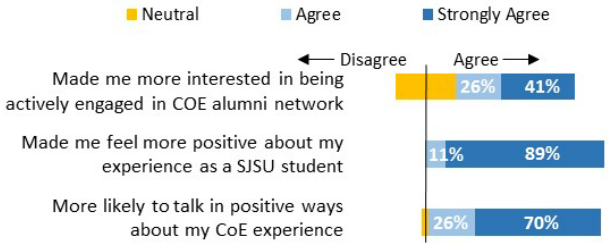

Fig. 6. 100% of respondents indicated that ELPS made them feel more postive about their university experience and most are more likely to stay engaged with the College of Engineering (CoE) in the future.

V. Conclusions

While scholarships provide resources that allow students to work less and thus place more focus on school, an intentional set of co-curricular activities offered in conjunction with awards can ensure that recipients get much more than the modest funds they receive. Such a program can help develop students who fully engage in college, not just inside the classroom, but also outside the classroom. Program alumni tend to be confident, successful engineers who have the skills and attitudes to be leaders in their careers from the start. A key ingredient is having mentors who really care about students – mentors who fully support and engage in every scholarship recipient's academic, career and personal growth. These are difficult to find, especially when they are being asked to do this above and beyond their other duties, with essentially no compensation. However, the right mix of programming and mentors can transform students' lives.

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REFERENCES

[1] G. D. Kuh, J. Kinzie, J. H. Schuh, E. and J. Whitt, Student Success in College: Creating Conditions that Matter. San Francisco, CA: Jossey-Bass, 2005.

[2] R. J. Cramer, and S. Prentice-Dunn, "Caring for the whole person: Guidelines for advancing undergraduate mentorship," College Student Journal. 41(4), 771-778, 2007.

[3] T. A. Campbell, and D. E. Campbell, "Faculty/student mentor program: Effects on academic performance and retention," Research in Higher Education, 38(6), 727-742, 1997.

[4] G. Crisp, and I. Cruz. "Mentoring college students: A critical review of the literature between 1990 and 2007." Research in Higher Education 50(6), 525-54, 2009.

[5] J. P. Dugan, and S. R. Komives, Developing Leadership Capacity in College Students." College Park, MD: National Clearinghouse for Leadership Programs, 2007.

[6] J. V. Farr, S. G. Walesh, and G. B. Forsythe, "Leadership development of engineering managers," J. Management in Eng., 13(4), 38-41, 1997.

[7] K. S. Athreya, and M. T. Kalkhoff, "The Engineering Leadership Program: A co-curricular learning environment by and for students." J. STEM Education: Innovations and Research 11 (3/4), 70-74, 2010.

[8] J. Tuberty, T. Anagnos, and E. Allen, "Leveraging scholarships to advance student success," 2014 ASEE Zone IV Conference, Long Beach, CA, 2014.

[9] L. Olson, A. J. Moll, D. Bullock, A. Jain, A., and J. Callahan, "Support model for transfer students utilizing the STEM scholarship program." 2016 ASEE Annual Conference & Exposition, New Orelans, LA, 2016.

[10] M. R. Anderson-Rowland and A. A. Rodriguez, "Summary of a 14-year NSF-sponsored S-STEM academic scholarship and professional program," 2016 ASEE Annual Conference & Exposition, New Orleans, LA, 2016.

[11] S. Cooley Jones and W. N. Waggenspack Jr., "S-STEM: ENG2 Scholars for Success 2007-2013." 2014 ASEE Annual Conference & Exposition, Indianapolis, IN, 2014.

[12] E. A. Eschenbach, M. E. Virnoche, and T. J. Evans, "Influences of S-STEM funding: Final outcomes of four year scientific leadership scholars program including improvements to department retention practices," 2011 ASEE Annual Conference & Exposition, Vancouver, B.C., 2011.

[13] L. Massi, M. Georgiopoulos, C. Y. Youn, C. M. Ford, and P. Lancey, "Internships and undergraduate research: Impact, support, and institutionalization of an NSF S-STEM program through partnerships with industry and funding from federal and local workforce agencies," 2013 ASEE Annual Conference & Exposition, Atlanta, GA, 2013.

[14] S. Sheppard, S. Gilmartin, H. L. Chen, K. Donaldson, G. Lichtenstein, O. Eris, M. Lande, and G. Toye, Exploring the Engineering Student Experience: Findings from the Academic Pathways of People Learning Engineering Survey (APPLES). TR-10-01. Center for the Advancement of Engineering Education (NJ1), 2010.