

Support Model for Transfer Students Utilizing the STEM Scholarship Program

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Lessons Learned from S-STEM Transfer Student Scholarship Program

Abstract

This paper describes how the College of Engineering at Boise State University utilized a National Science Foundation S-STEM award from 2011 to 2016 to support transfer students in their path toward graduation. The need for this support was a result of both Boise State University College of Engineering's transition from a 2-year pre-engineering program to the establishment of Bachelors of Science in Engineering Degree programs in 1997 as well as the establishment of the College of Western Idaho as a regional community college in 2007. Both of these factors led to an increase in the numbers of incoming engineering students transferring from other institutions of higher education to complete their degree. These students were generally ineligible for most Boise State University scholarship programs which are mainly aimed toward students entering college directly from high school.

In this paper we describe how our program connected transfer students with university staff, faculty and resources. To date, this program has a 100% retention rate, with the exception of one student on an official leave of absence, and a projected 100% graduation rate with 91% of the students already graduated. In addition, approximately 22% of scholarship graduates are pursuing graduate degrees.

Introduction

Boise State University's College of Engineering was founded nearly two decades ago in response to regional demand for engineering education from industry leaders. The College of Engineering student body now comprises approximately 3,000 students, reflecting approximately 15% of the university's enrollment. In 2014-15, 52% of the university's students were eligible for Pell Grants, and 19% of the engineering graduates were first-generation college students. Despite the overwhelming need for financial support, the young alumni base of the college has not yet yielded substantial endowments so as to provide a significant scholarship base. Also, our students are highly debt-averse, and often delay graduation because of financial needs. Funding from the National Science Foundation has therefore been critical. Across eleven years between fall, 2004 and fall, 2015, a total of 326 unique students have received scholarships from CSEMS and S-STEM programs at Boise State. This paper reports on one of these programs targeted toward transfer students.

For the first ten years of its history, Boise State University offered only Associate's degrees through the College of Applied Technology. In 2007, the College of Applied Technology was separated to become a regional community college, located approximately 20 miles to the west. Because of this opportunity to begin their studies at a community college, the number of students transferring into Boise State's College of Engineering has substantially increased. Transfer students have unique financial needs; as many exceed their financial aid allocation before they graduate due for a number of reasons including entry mathematics level, which may be

substantially below calculus. Also, most of our university level scholarships are focused on traditional students.

Along with financial need differences, transfer students' life demands and needs differ from traditional students. These students are balancing college classwork with part time employment and raising families, and struggle to incorporate additional activities and time commitments. As a result, the focus of the transfer cohort activities reported in this paper has been on a combination of support services geared to student success with social activities for helping students make connections among their cohorts, other students and faculty.

Scholarships Awarded

An analysis of the transfer student body revealed that approximately 55% of our graduating students in 2009-10 graduated with transfer credits. Of transfer students enrolled at that time, 32% came with fewer than 15 credits, 21% with 15 to 29 credits, 27% with 30 to 60 credits and 20% with 60 or more credits earned. Based on the wide variation in credits earned, we designed an array of programming events designed to meet the needs of transfer students, described later on in this report in the section on programming.

Over a five-year period, awards were made to 54 qualified full time students pursuing degrees in engineering, computer science or mathematics. In addition to demonstrating financial need, qualifications included that the students be United States citizens or permanent residents and show academic talent with a minimum GPA of 3.0. Based on Boise State University's determination of unmet financial need from FAFSA records, NSF scholarships for students ranged from \$1,500 to \$3,000 per semester. These amounts varied from the originally proposed funding levels of \$1,000 to \$5,000 per semester due to the large number of qualified applicants, increased financial need and time on scholarship. Students were supported for between one and four years, with the average length of award being four semesters. Eligibility requirements also required students have between 6 and 60 transfer credits from a community college or university.

Programming and Programming Results

Mathematics Programming

Prior work has shown the importance of early success in mathematics in terms of earning a good course grade. Moreover, an analysis of retention predictors showed that success in a student's first math course taken is a very strong predictor of retention in STEM.^{1,2} Analysis of our transfer students in fall 2011 showed that approximately 60% of transfer students in engineering, computer science or mathematics entered at the Calculus level or lower. Based on this data and prior work, the programming for this grant was designed to include an initial focus on math review and support.

To facilitate individual, independent review of mathematics at pre-calculus levels and below, we promoted the ALEKS online mathematics review program during transfer orientation. The program was made available to students at no charge through the Idaho NSF STEP program (2010-2015).^{3,4} During this same time, significant pedagogical improvements were underway in Calculus I funded through two other grants (NSF STEP and WIDER) that also helped with

Calculus I outcomes. Profound changes were made across all sections of Calculus 1 in terms of pedagogy, homework, timing of course content, grade computation and exam content with the objective to raise first semester, full-time retention of students in STEM majors. Year-long faculty learning communities (FLCs) were developed which focused on active learning pedagogy, common homework, and common due dates and times. The FLC structure facilitated buy-in, communication and feedback between instructors who came to agreement on learning goals and content for each individual lesson. All members of the FLC chose to adopt a similar pedagogical approach which included devoting class time to solving problems, working in small groups; these were facilitated by the lead instructor with a learning assistant. Pass and withdrawal rates pre- and post- implementation revealed an increase in pass rate of 13.4% and a drop in withdrawal rate of 3.9%. Results from anonymous faculty surveys showed that faculty changed their teaching practices in calculus and observed positive effects of all their classes.⁵

One Stop Shop

In order to provide convenient and continuous support for transfer students and for other students receiving funding from the NSF S-STEM programs, we developed a “One Stop Shop.” The genesis for this concept was based on what had been learned in our first S-STEM grant, where a single point of contact was found to be critical. This concept was continued and expanded in this grant to assist students. A Scholarship Coordinator was designated who provided students with a single point of contact to assist with academic, career and financial needs. After one year, the location of the coordinator was moved to the College of Engineering Advising Office (CEAO). This location proved to be instrumental as it was very convenient for upper division students to make contact with the Scholarship Coordinator (a licensed professional engineer) and to drop-in informally from time to time. Also, the CEAO provided a convenient location for offering some of the social events during the grant. Academic advising routinely takes place in the CEAO, and other professional staff members are also present, providing a sense of community and belonging to all students, not just the scholarship recipients.

Flexible Programming

Over the grant period the Coordinator organized semi-regular monthly events that were held both on and off campus during a variety of flexible times to allow for variety in class schedules, commuting time, family and work commitments. These activities were in addition to dedicated advising and career support and consisted of a combination of social events such as rock climbing and yoga to career development workshops covering resumes, internships, research and career fair preparedness. These events were frequently conducted in collaboration with other STEM groups including faculty and staff. Given the proximity and unique access to a local hands-on science center, events were opened to the transfer student cohorts and their families providing special access to local and national exhibits. A website along with emails to the transfer cohort were used to communicate information and details on event programming; in addition a Facebook group was created to facilitate communication in the final years of the grant. Surveys of students following years 1 and 3 of the grant confirmed students’ desire for a combination of informal social and network activities as well as more career focused opportunities. Results from a post grant survey sent to all scholarship recipients rating the benefit of various programming to the students was compiled for eleven activities, many of which were repeated over the grant period. Students were asked to rate only the programs for which they participated in on a scale ranging from no benefit, to some or very beneficial with a neutral

option included. Overall for those that participated in the various events, 54% reported an event as being very beneficial with 75% of the respondents reporting events providing some benefit. The highest rated events are listed below in Table 1.

Table 1 – Rating of top 5 programming events by grant participants

Programming	% reporting very beneficial	% reporting some benefit
finals and holiday socials	63%	72%
internship & resume workshops	61%	92%
academic & career advising	60%	73%
networking luncheons w/faculty & staff	60%	80%
yoga and rock climbing	55%	67%

Scholarship Results

The initial goals were to provide 40 students with funding. Due to the significant need for scholarships for transfer students, funding was provided to 54 students for as few as one year and as many as 4 years. On average students were on scholarship for 2 years. This grant, like previous College of Engineering S-STEM programs, was successful in recruiting student participation from the two largest underrepresented populations in the region - persons of Hispanic descent and women. These student populations were targeted by both email and phone calls to ensure they knew of the program and encourage their application. In addition, outreach to staff within other university programs that support these minority groups was also made including to the College Assistance Migrant Program (CAMP), the Center for Multicultural Education Opportunities TRIO Student Success Program as well as the Louis Stokes Alliance for Minority Participation (LSAMP). As a result, the pool of students who received support was significantly more diverse relative to the college and university, with 22% (12/54) of the scholarship recipients being female and 15% (8/54) Hispanic. These values may be compared with 12.7% female and 9.5% Hispanic, for engineering and computer science majors, and with 53% female and 7% Hispanic at this university (2011-2012 basis).

One of the most significant results of this program has been its 100% retention rate with the exception of one student who is on an extended leave. This is a very strong result, given that internal data shows that for a variety of financial, personal and other reasons, between 2008 and 2012, 17% of all STEM juniors stopped out of the university for a semester or more. Hence, receiving the scholarship likely enabled students to continue toward their degree without stopping out. A comment received during the post-survey, “I was able to focus my efforts and make school and my graduation my priority,” highlights the importance of the financial support of the program. A survey conducted during year one of the program reinforced the post survey results – that the scholarship lessened financial pressure including the benefit of reduction in work hours followed by a reduction in student loans.

In addition to retention, this program has delivered very strong graduation results, with an overall expected STEM degree attainment level of 100% with 91% (49/54) of the students having graduated as of fall 2015. This may be compared with university-wide six and eight-year graduation rates of 28% and 34% (respectively, 2004 basis), and a six-year graduation rate for

engineering and computer science majors (2006 basis) of 29%. S-STEM transfer programs at Arizona State University have had similar success with graduation rates ranging 90-95% for students supported by the development of a transfer students support program.⁷

Further evaluation of the average cumulative grade point average (gpa) of transfer S-STEM graduates shows an increase over non supported students. The average cumulative for graduates of the program is 3.49 compared to an average cumulative gpa of 3.19 for the control group consisting of transfer students with the College of Engineering at Boise State who also graduated between fall 2011 and spring 2015. Additional analysis of students' final cumulative gpa upon graduation which includes transfer credits as well as those taken at Boise State compared to only their Boise State gpa reveal an average decrease of only 0.03 points. This minor drop occurred during the students first semester at Boise State but is less than the typical drop often referred to as "transfer gpa shock" experienced by upper division transfer students of as much as half a grade point.⁷ Studies done at Boise State of transfer students enrolled at Boise State between fall of 2000 and summer of 2009 showed a drop of 0.15 for a similar transfer cohort.⁸

The average number of degree-enrolled years for graduation of the S-STEM transfer cohort was 4.7 years compared to 4.9 years for the 293 transfer students that graduated with an engineering or computer science degree between fall 2011 and spring 2015. The post-survey confirmed the impact the scholarship had on students' time to graduation as shown in Table 2. Students were asked to rank 5 statements related to the benefit of the scholarship to them. While no single statement was overwhelming selected by respondents, a review of the top three statements by students demonstrates that a majority reported that the scholarship both prevented them from attending part time and reduced their time to graduation. Students reported that the financial support was critical to their retention and graduation. A comment included in the survey by one student indicated: "If not for the scholarship I would have dropped out." A majority reported that the scholarship accelerated their time to graduation, freeing up time for them to study and take additional classes.

Table 2 – Post survey ranking of statements by students

My scholarship...	% ranking statement #1	% ranking statement #1 or #2	% ranking statement #1, #2, #3
prevented me from going part time.	27%	61%	78%
reduced my time to graduation.	22%	44%	72%
allowed me to increase my credit load.	16%	39%	50%
prevented me from taking a semester off.	16%	27%	50%
allowed me to take summer classes.	11%	22%	53%

Graduate school: Of the 49 students that have graduated, 11 students (22%) are pursuing graduate school. This is more than double the college of engineering average rate of undergraduates that go on to graduate school of approximately 10% based on exit surveys. While other universities have attained a higher percentage of students moving on to graduate school (50-60%) this scholarship rate is more on par with the national average and a significant increase over non-scholarship students at Boise State.^{7,9}

Challenges and Lessons Learned

A variety of programming was offered throughout the five years of the grant. One of the issues encountered was that without a formal time-slot associated with a weekly meeting such as other programs offer, it was a challenge to offer events that transfer students could readily attend.^{10, 11} While our program required students to only attend events 3-4 times a semester or 6-8 times a year, many of the transfer students had family and work obligations that prevented them from participating. One student reported in the post-survey, “My biggest obstacle in the program was finding time for the activities. I am a single parent and between jobs, school, family, internships and clubs, my time was very limited and I was not able to be involved in all the activities.”

To overcome the scheduling challenges, we offered a wide variety of programming opportunities and times. We accomplished this by working closely with other entities on campus such as LSAMP, and other student success oriented activities including those offered by the career center. These efforts to create a variety of events and times to work with students schedules was found by students to sometimes to be overwhelming. In reviewing the literature, other grant programs have operated in a more structured manner, requiring students to register for a specific class (e.g. Academic Success and Professional Development) related to their scholarship. This model has proven a successful strategy not only for scholarship recipients but for others who enroll in the course as well.⁹ This model is something to consider for future scholarship projects as it simplifies scheduling and affords a structured timeslot.

The implementation of a Scholarship Coordinator as part of a “one-stop shop” for the grant was instrumental for connecting to students to resources. We were able to have a dedicated staff member as a result of the college of engineering supporting the remainder of the staff member’s position on soft money. The coordinator’s location in the CEOA allowed her to be readily available to S-STEM students while also supporting the advising office. As an advisor, the Scholarship Coordinator was able to provide knowledge about university policies and procedures including those related to financial aid. Other programs have the importance of enhanced advising in successful retention, including the use of both peer and faculty mentoring as part of their structure.¹⁰ For this scholarship program, informal mentoring by students and faculty proved to be successful but could be expanded upon in the future. The Scholarship Coordinator as a licensed professional engineer was able to represent a number of disciplines and provided connections to local professional and technical societies for opportunities outside of the university.

Summary and Suggestions for Future Scholarship Programs

The NSF S-STEM transfer scholarship program at Boise State University has been very successful. In particular students on the scholarship have been retained with the exception of one student on an extended leave, and we are projected to have a 100% graduation rate with 91% of the students already having graduated before the grant’s end. Students who received this scholarship are pursuing graduate degrees at approximately double that of non S-STEM transfer students. The post-survey showed that students report the scholarship as being critical to their timely graduation.

While students enjoyed the informal, active social events, and requested flexible programming, we recommend a more structured approach to event programming in order to facilitate a formal cohort development in a streamlined structure. Such a structure might include a class or set meeting time; this has been shown by Anderson-Rowland, et al. for example, to be effective.¹¹

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References

1. Callahan, J. and Belcheir, M. (2017). "Testing Our Assumptions: The Role of First Course Grade and Course Level in Mathematics and English," *Journal for College Student Retention*, 19(1).
2. Gardner, J., Pyke, P., Belcheir M. and Schrader, C.B. (2007). "Testing Our Assumptions: Mathematics Preparation and Its Role in Engineering Student Success," Paper presented at 2007 Annual Conference & Exposition, Honolulu, Hawaii. <https://peer.asee.org/2314>
3. Callahan, J. and Garzolini, J. (2015). "An Elective Mathematics Readiness Initiative for STEM Students," Paper presented at the American Society for Engineering Education Annual Conference & Expo, Seattle, WA 10.18260/p.23520 <https://peer.asee.org/an-elective-mathematics-readiness-initiative-for-stem-students>
4. Callahan, J., Garzolini, J., Hunt, G., Guarino, J., Bullock, D., Shadle, S., Schrader, C.B. (2011, June) "The Idaho Science Talent Expansion Program: Freshman Orientation for STEM Majors," Paper presented at 2011 Annual Conference & Expo, Vancouver, BC. <https://peer.asee.org/18719>
5. Bullock, D., & Callahan, J., & Shadle, S. E. (2015, June), "Coherent Calculus Course Design: Creating Faculty Buy-in for Student Success," Paper presented at 2015 ASEE Annual Conference and Exposition, Seattle, Washington. 10.18260/p.23694. <https://peer.asee.org/23694>
6. Zhang, G., Anderson, T., Ohland, M., Carter, R., and Thorndyke, B., "Identifying Factors Influencing Engineering Student Graduation and Retention: A Longitudinal and Cross-Institutional Study", (2002) Annual American Society for Engineering Education Conference Proceedings, Montreal, Quebec.
7. Anderson-Rowland, M.R., Rodriguez, A.A., Hall Jr., R.A., McBride, P.B., Pangasa, R., Saber, J.M., Vandergilder, C., Grierson, A., "Leveraging S-STEM Scholarship Programs", (2012) Annual American Society for Engineering Education Conference, San Antonio, Texas.
8. McGuire, S.P, Belcheir, M., (2013). "Transfer Student Characteristics Matter," *Journal of College Student Retention: Research, Theory & Practice* 15 (1) 37-48.
9. Anderson-Rowland, M.R., Rodriguez, A.A., Grierson, A., (2013) "S-STEM Programs for Transfer and Non-Transfer Upper Division and Graduate Engineering and Computer Science Students", Paper presented at the 2013 Annual American Society for Engineering Education Conference, Atlanta, Georgia.
10. Laier, J., Steadman S. J., (2014). "Improving Transfer Student Success," Paper presented at the ASEE Annual Conference and Exposition, Indianapolis, Indiana.
11. Anderson-Rowland, M.R., (2014). "Transfer Students: Lessons Learned over 10 Years," Paper presented at the 2014 Annual Conference and Exposition, Indianapolis, Indiana.