A Study of the Impact of a NSF Internship and Conference Participation Program on Student Success

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Abstract

A NSF program supporting internships and conference participations for undergraduate engineering/computer science students was performed at the University of New Mexico main campus. In this work, data on the positive impacts of such activities on student academic success are presented here. The data clearly shows the positive correlation of such activities, including faculty mentoring, with student retention and graduation.

Introduction

The School of Engineering at the University of New Mexico received funding in 2011 from National Science Foundation to begin a Science, Technology, Engineering, and Mathematics Talent Expansion Program (STEP). UNM's STEP program first received funding in 2011; the first student cohort began the STEP program in the spring of 2012. Since then, a new cohort of students participated in the STEP program every year, beginning each fall semester. The last STEP cohort started in the fall of 2018. STEP offered six mentoring sessions per year, internships for selected students, opportunities to attend conferences, and the possibility of a second internship for students who began STEP as freshmen. The New Mexico Statistical Analysis Center assessed implementation and outcomes throughout the project. Short-term outcome assessments focused on student knowledge of resources, engagement, attitudes, perceptions, and program satisfaction. The evaluation also measured the ultimate goal of STEP: to increase graduation rates among engineering students at UNM. This report highlights some of the key findings from the evaluation.

Literature review

In 2007 the National Science Board published a report drawing attention to the growing need for engineers in the workforce, and the concurrent deficit of the U.S. workforce to meet that need. One of the key challenges they identified is retaining students in engineering programs. Many factors influence persistence, including both individual (demographics, prior academic performance, self-efficacy) and institutional (teaching quality, faculty-student relationships, academic support services, financial support, and opportunities for professional development) [1,2,3]. While some of these factors cannot be changed (e.g., sex, parental income status, race/ethnicity, first-generation college student), others can be influenced. The research identifies

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institutional factors that influence retention, such as teaching quality, faculty-student relationships, academic support services, financial support, and opportunities for professional development [4,3]. These are all dynamic factors that can be addressed to improve persistence.

Another factor that can be influenced is social ties. Students who have social ties to their institution are thought to be less likely to drop out [5]. Meyer and Marx argue that studies show students who feel "comfortable and accepted" are less likely to drop out [2].

Finally, improving student self-efficacy is important for retention. Self-efficacy refers to perceived self-confidence or level of competence [6]. Strong self-efficacy can bolster commitment to academic and career-related goals. Notably, Moller-Wong, et al. argue that commitment to personal goals is the most important determinant of persistence [3]. A variety of factors may influence self-efficacy. For example, course difficulty or failure can lower academic self-efficacy, leading to dropping out of engineering [2]. Thus, identifying problems early on and directing students to available resources may help.

Mentorship (including discussing role expectations), professional socialization experiences (e.g., conferences) and real world learning experiences (e.g., internships, co-ops) [7,8,6] may also improve self-efficacy. Mentoring can also facilitate career advancement, provide opportunities for networking, and increase both satisfaction and retention rates among students [9,6,10]. Mentoring can be especially beneficial for students most at risk for dropping out, including women and other underserved populations [9,6].

Internships are believed to be positively related to both retention and graduation, and are an opportunity for students to learn about engineering as well as work expectations and procedures. Studies indicate that engineering faculty believe internships to be a valuable tool for undergraduate engineering students [2] and that retention is related to both work self-efficacy and is improved when students engage in internships or cooperative education programs (co-ops) [6]. Further, co-ops and internships are related to increasing not only hard skills but also improved work self-efficacy [11,6], as internships can be a crucial component to developing an identity as an engineer [8]. Finally, internships may be provide additional financial assistance for students in need.

The UNM STEP program incorporates many of the elements identified in the literature as aiding retention. Providing information on campus resources (tutoring, scholarships, financial aid, etc.), encouraging and facilitating social ties, mentoring, conferences, and internships are all key components of the program.

Methods

The evaluators identified several key questions related to outcomes. Here, we report on the following:

- To what extent is there evidence of a change in self-efficacy?
- In what ways do STEP students benefit from participating in STEP?
- Are students who participate in STEP more likely to remain in the School of Engineering relative to those in the comparison group?
- Are students who participate in STEP more likely to graduate with a degree in engineering relative to those in the comparison groups?

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The evaluation protocol involved administering three surveys to all students enrolled in the STEP program: one prior to beginning STEP, a second at the end of the first semester, and a third at the end of the year. Evaluators asked students who participated in the internship component to complete a fourth survey after completing the internship. The results of these surveys inform short-term outcomes, including the first two questions above. Analyses include descriptive statistics.

Evaluators measured retention in engineering major to the most recent semester and graduation with a degree in engineering by comparing STEP students and a comparison group of similarly situated students using institutional data. Here, "STEP students" are those who completed all mentoring sessions, whether or not they completed an internship. Thus, those students who began the STEP program but dropped out during the year are not included.

The criteria for participation in STEP changed somewhat over time. Initially, the program targeted students who were in their first year of Engineering, typically sophomores at the University. Beginning in 2014, STEP program staff expanded the program to allow students less advanced in their college careers to participate in STEP. In 2017, students who were further along in their academic careers were allowed to participate.

The STEP program coordinator created the comparison group. This included students who would have been eligible to participate in the STEP program, but did not. The timing of the construction of these cohort lists varied, and is important as it impacts retention measures. The STEP program coordinator constructed the first four cohorts (2011 to 2014) and the last cohort (2018) within a few months of the beginning of each academic year. However, the cohorts from 2015 to 2017 were constructed retrospectively, in the spring of 2018, using a pool of students who were in the SOE. Thus, the cohorts constructed during the same academic year that the STEP students entered the program included students who subsequently dropped out of the School of Engineering (SOE). Conversely, those students identified in the 2015-2017 cohorts were identified retrospectively and included *only* those who were still in the SOE at the time the list of potential comparison group members was pulled in 2018. Thus, students who left the SOE prior to that were not included in these cohort comparison groups.

Besides bivariate descriptive statistics, we performed multivariate logistic regression analyses to identify variables associated with retention in engineering and graduation with a degree in engineering, including whether participation in STEP was a significant predictor of retention. We compared only the STEP participants and cohort comparison group for these analyses.

Results

Survey results suggest increased self-efficacy in two areas. The vast majority of students either agreed or strongly agreed that they were surer about their field of study (88.2%) and their career goals (86.3%) as a result of STEP. Students also report increased departmental connections due to their participation in STEP. Specifically, 86.3% of students surveyed reported that they met other students in their major, and 89.3% reported they feel more supported by faculty due to their participation in STEP.

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Table 1. Measurements of confidence, social ties, and support

As a result of STEP:	Strongly Agree	Agree	Disagree	Strongly Disagree	N
I am more sure about my field of study*	45.4%	42.8%	9.5%	2.4%	423
I am more sure about my career goals*	42.3%	44.0%	11.3%	2.4%	423
I have met other students in my major*	44.2%	42.1%	11.1%	2.6%	423
I feel I have more support from faculty*	49.3%	40.0%	8.3%	2.4%	422

*Statistically significant difference from hypothesized value

Benefits of STEP Participation

Students reported receiving many benefits from participating in STEP. Most often, they noted the internship opportunity and receiving career advice. Other frequently noted benefits include networking, increased knowledge of the department, and improved job self-efficacy. Two-thirds of students reported they received academic guidance and over half said their academic skills improved due to STEP, important for developing academic self-efficacy. About one third of students responded that they did receive "other" benefits. Most students, regardless of whether they selected "yes" to receiving other benefits, elaborated on benefits already highlighted on the checklist. For example, one student wrote "*I was able to interact with faculty members and students from my department who gave me some really good advice and information for the future*." In addition to elaborating on networking opportunities, students also frequently mentioned benefitting from the internship and job opportunities they found through the STEP program.

Table 2. How students benefitted from STEP program

Benefits	All years
Internship opportunities	87%
Received career advice	87%
Networking with faculty	86%
Increased confidence in career path	86%
Increased knowledge of department	86%
Networking with professionals in field	82%
Increased understanding of field	82%
Improved personal skills/personal growth	81%
Increased knowledge about scholarship opportunities	80%
Networking with students	78%
Improved job skills	78%
Academic guidance	75%
Opportunities to attend conferences	74%
Improved academic skills	55%
Other	31%
N	354

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Retention and graduation

Using logistic regression, we examined the variables associated with retention among students in the 2011 to 2014 and 2018 cohorts. Female students were significantly less likely than males to remain in engineering even after controlling for other factors. The association between pre-STEP earned-to-attempted credit ratios and retention was large and significant in this model: students earning greater proportions of their attempted credit hours were much more likely to remain in engineering. STEP participation was a significant variable in this model. Thus, after controlling for demographics, financial aid, and academic performance, STEP participants were almost twice as likely to remain in engineering as students in the cohort comparison group.

Table 3. Logistic Regression Results for Retention in Engineering, 2011-2014, 2018 cohorts

Variable	Exp (b)
Age at STEP	1.009
Female	.599*
Minority	1.158
First generation college student	1.114
Amount of initial financial aid	1.000
Pre-program GPA	1.100
Pre-program earned/attempted credits	12.787*
STEP participation	1.706*
Constant	.394
Model Fit	19.310, 8df, p<.05
N	929

*p≤.05

Next, in order to determine whether participation in STEP is significantly related to graduating with a degree in engineering, we employed a multivariate logistic regression model for those in the 2011 to 2015 cohorts who graduated by Spring 2019. In this model, like retention, three variables were significantly related to graduating with a degree in engineering: gender, pre-program earned to attempted credits ratio, and participation in STEP. The odds ratios indicate that females are significantly less likely to earn an engineering degree and that those with higher earned credit ratios are significantly more likely to graduate with a degree in engineering. The odds that a STEP participant would earn an engineering degree were about twice that of the comparison cohort group after controlling for academic history, demographics, and other factors.

Table 4. Graduated with a degree in engineering, 2011 to 2015 cohort graduates

Variable	Exp (b)
Age at STEP	.996
Female	.478**
Minority	1.021
First generation college student	1.537
Amount of initial financial aid	1.000
Pre-program GPA	.873
Pre-program earned/attempted credits	35.881**

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STEP participation	2.058*
Constant	.428
Model Fit	27.33, 8df, p<.001
N	715

*p≤.05

Conclusion

The results from this portion of the evaluation indicate that STEP has been a successful program. Students report increased self-efficacy, connections to others in their department (faculty and students), and improved academic and career skills. Furthermore, even after controlling for factors like demographics and academic background, students who participated in STEP were more likely to remain in Engineering and more likely to graduate with an Engineering degree than those in the comparison group.

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