

Activities Used in Improving College Retention and Graduation: A Project Focused on Internships, Faculty-Mentoring and Other Career Development Activities

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Authors' contributions

This work was carried out in collaboration among all authors. Authors JR, MS, JD, GW and KD worked on data collection and statistical analysis and reporting, including the collection of student statements as evaluators of the project. Author EC worked on the execution of this project and its activities throughout its period of performance. Author TK worked on the inception and overall management of this project, as well as the writing of this paper.

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ABSTRACT

The University of New Mexico (UNM) embarked on a project funded by the National Science Foundation (NSF) to engage in activities that are believed to support retention and graduation of STEM students (specifically engineering and computer science students). The project focused on the following activities: internships, faculty-mentoring and other career development activities such as conferences, interacting with industry, financial aid info, resume building workshops, interview skills workshops. The project focused on early career students (mostly sophomores and some freshmen). The methods of this research involved data collection and analysis, surveys, bivariate descriptive statistics with statistical significance, and multivariate logistic regression analysis. The

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authors have found evidence supporting that such activities have played a positive role in student's continued retention, eventual graduation and overall self-confidence in their engineering/computing persona going forward. Other higher education institutions are encouraged to pursue similar activities.

Keywords: Internships; career development activities; undergraduate students; student success; retention; NSF.

1. INTRODUCTION

This paper outlines some of the efforts undertaken by a UNM School of Engineering (SOE) project funded by the NSF. The name of the NSF Program is the STEP (Science, Technology, Engineering, and Mathematics (STEM) Talent Expansion Program) Program. Currently, the STEP Program is no longer offered by NSF and has been replaced with two different programs: Improving Undergraduate STEM Education (IUSE) Program, and S-STEM (Scholarships in STEM). Per mandate from the National STEP Program, students participants have to be early career in their studies, i.e. sophomores and/or freshmen.

The UNM STEP project was a 5-year project funded in 2011, started in 2012 and involved the following departments: Civil, Mechanical, Electrical, and Chemical/Nuclear and the Computer Science. It finished in 2019 after time extension of the project. It had four main components: Mentoring, Internships, Targeted Retention Activities (e.g., conferences), and Incentives (e.g., a second internship). This particular STEP Project is different than other NSF STEP projects in its unique model, which consists of spending most of the funding on internships and conferences. The long-term aim of the UNM STEP is to promote retention and graduation by strengthening students' ties to their majors and to the institution.

The following research questions were formulated: (i) Do students who participate in STEP report improved support from mentors? (ii) Are interactions between STEP students improved throughout the participation in the program? (iii) Are students who participate in STEP more likely to remain in Engineering relative to similarly situated students who did not participate in STEP? (iv) Are students who participate in STEP more likely to graduate relative to similarly situated students? (v) To what extent do students report a positive internship experience and in what ways?

The details of the four main components of the UNM STEP Project are as follows:

- i) Mentoring: about 25 mentors participate (5 faculty members nominated from each of the five departments) in 6 mentoring sessions a year—3 per semester, with some older peers' involvement as well. Each group size varies by major/department. The last session consists of a talk by an expert (industrial or academic). Two of the sessions (second and fifth sessions) involve career development activities, such as resume writing, interview skills, and financial aid workshops. These two sessions bring all groups from all departments together with their mentors, and food and drinks are provided.
- ii) Internships: there are up to 75 funded internships/year allotted for the summer (8 weeks). The internships can be off-campus at companies/agencies for practical internships, or on-campus with faculty mentors for research experience.
- iii) Targeted Retention Activities: there is an ability to fund 75 professional conference participations per year.
- iv) Incentives: sophomores have the opportunity to complete a second internship if they finished a successful year with the Project as a freshman.

Every academic year, a new STEP cohort (which self-selects since this is not a mandatory program to participate in) starts in the Fall semester (with the exception of the first year when a cohort started in the Spring 2012 semester). By the end of the academic year, a STEP student who has completed all of the mentoring sessions is eligible to participate in an internship that is paid for by the Project. Most students participating in the internships are sophomores who have started their STEP year during their first sophomore semester in their major. A large percentage of students participating in the conferences are freshmen or pre-majors (i.e. not admitted into an engineering/CS major yet).

2. LITERATURE REVIEW

The problem with retention of undergraduate engineering student has been a focus of the NSF [1]. NSF reported that only 56% of students who began with a major in engineering remained in the engineering program after five years, which is lower than non-engineering majors. Several factors for persistence of engineering students in a public university setting were studied by [2], and in a private university setting by [3]. Major et al. [4] studied one factor affecting persistence in engineering. While [5] report that the average engineering completion rate is about 57%, recent data indicates that 61% of engineering students graduated within five years [1]. Income affects degree attainment [6] and minority status [1]. There are other factors that can affect retention such as demographics (e.g., sex, income status, race/ethnicity, first-generation college student), prior academic performance/background (e.g., high school GPA, ACT/SAT scores, math and physics background), learning styles, and self-efficacy [5,7,8]. Other factors such as teaching quality, faculty-student relationships, academic support services, financial support, and opportunities for professional development also affect retention [8,9]. Early and strong integration into the institution has been associated with increased retention [10].

Self-efficacy refers to perceived self-confidence or level of competence [11]. Self-efficacy is strongly associated with both retention in academic institutions and careers in engineering [12]. The literature indicates that there are a variety of ways to improve academic self-efficacy. These include advisement, mentoring, co-ops, internships, increasing social and intellectual ties to the institution, and improving support as well as faculty-student interactions [11,13]. These can be bolstered through mentorship, professional socialization experiences, and real world learning experiences, such as internships [11,14,15]. students who are better integrated into the institution, both academically and socially, are more likely to remain at the institution and to ultimately graduate. This institutional engagement is one key to student retention, especially in the first years of college [16].

Mentoring programs have been shown to increase self-efficacy, facilitate career advancement, provide opportunities for networking, and increase both satisfaction and retention rates among other benefits [11,17,18]. Mentoring can be especially beneficial for

students most at risk for dropping out, including women and other underserved populations [11,17]. The impact of mentoring depends on several factors, e.g. the type of mentoring and communication levels [17,19]. Meyer and Marx [5] argue that students who feel “comfortable and accepted” are less likely to drop out.

Studies indicate that engineering faculty believe internships to be a valuable tool for undergraduate engineering students [5], and that retention is improved when students engage in internships or cooperative education programs (co-ops); these factors are also related to work self-efficacy [11]. Furthermore, co-ops and internships are related to increases not only in practical skills, but also in work self-efficacy [11,20]. Internships can also be a crucial component when it comes to developing an identity as an engineer [15]. Another negative factor on retention is the need by certain students to work while attending college [21]. Summer internships can provide students with financial assistance or extra source of annual revenue.

Three of the authors participated in another paper on the UNM STEP [22]. In that work, multivariate analyses were performed to determine the effect of the STEP activities on retention, graduation rates and other academic success metrics. Evidence to support the impact of STEP on retention and graduation was observed. Also, basic statistics showed the high retention of pre-major students following professional conference participation trips [22]. This previous work addressed the last three research questions stated above for the STEP program.

3. METHODOLOGY

The criteria for participation in STEP changed overtime in conjunction with varying yearly levels of participants. Initially, the program targeted students who were in their first year of Engineering, typically sophomores at UNM. In 2014 the STEP program at UNM expanded to allow students who were less advanced in their college careers to participate, and then expanded in 2017 to students who were a bit further along in their academic careers. Throughout this work, “STEP students” refers to those who completed all mentoring sessions, whether or not they completed an internship. Those students who began the STEP program but subsequently dropped out were not included in the sample.

In order to evaluate the STEP program's impact on retention and graduation in engineering, a comparison group of similarly situated students was created by the STEP program coordinator. Using institutional data, the comparison group was formed by identifying students who would have been eligible to participate in the STEP program but did not.

In addition to gathering institutional data, the evaluators administered 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. It is likely that the majority of students who completed the end-of-year survey were also those who remained in the STEP program. These surveys focused on students' experiences with both mentors and other students prior to and throughout the duration of the STEP program. Evaluators asked students who participated in the internship component to complete a fourth survey after completing the internship, which asked students to report their perceptions of their internship experience. The internship results survey is in [22].

The end-of-year survey includes questions asked in previous surveys to assess students' perceptions over time. In addition, we ask students about the fifth and sixth mentoring sessions, as well as their perceptions of the STEP program. For each item discussed below, the total number of responses varies depending on how many students were included in the analysis. Some students completed all three surveys (pre-program, end of semester, and post-program), while others completed two of the surveys or only the end-of-year survey. Furthermore, some students may have skipped questions, affecting the total number of responses.

Significance testing included a variety of measures. For pre/post ordered pairs within specific cohort years and within all cohort years, the authors used the Wilcoxon signed-rank test and the sign test. All possible pairs were analyzed (pre-survey to end-of-semester, end-of-semester to end-of-year, and pre-survey to end-of-year). We employed the Kruskal-Wallis H test and median tests for significance testing between cohort years (both pre-survey and end-of-year survey). In cases where the results differed, we explored the source of the discrepancy. If it was due to outliers, we chose the median test. Chi-square tests measured differences with nominal

data. Tests resulting in p-values less than $\alpha=0.05$ are considered to represent statistically significant differences. Percentages reported in the surveys here have a rounding error of $\pm 1\%$.

Analyses include bivariate descriptive statistics. We also performed multivariate logistic regression analyses to identify variables associated with graduation overall 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 the cohort comparison group where appropriate. Multivariate analysis, involving the comparison group, was performed prior in Khraishi et al. [22] and hence not re-produced here.

4. RESULTS AND DISCUSSION

4.1 Comparative Analysis of Changes in the Major of Students

To determine whether there have been any significant changes in the composition of STEP participants, we compared the majors of students who completed each survey over time. There was very little fluctuation in the percentage of students from each major over time for the different cohorts. The reason for differences in the percentages for any given major over an academic year is either some attrition or the opposite, i.e. an increase in numbers. The attrition is obvious and is due to some students switching majors. The increase is due to two reasons: (1) some students joined the STEP program while in pre-major status and during the STEP year have converted that status to major status and thus are now officially in the concerned engineering/CS program, and (2) some students joined the STEP program a little late and after the pre-survey was already administered.

4.2 Perceived Support from Faculty and Staff: All Cohorts

In this section, we survey to ask the students to report on the level of support that they feel they receive from both faculty and staff. We asked these questions on the pre-program survey, the end-of-semester survey, and the end-of-year survey. Only those students who completed all three surveys are included in this analysis. Students' perceptions of faculty support over the course of their participation in STEP became more favorable over time. For each question, the

percentage of students providing responses of “strongly agree” increased from the pre-STEP survey to the post-STEP survey.

Responses from the cohorts were similar in all years and the changes observed across all cohorts were statistically significant for each question. More than 98% of students in the end-of-year survey reported knowing a faculty member they could address questions about their field of study to, an increase from 75% in the pre-STEP survey. Additionally, there was a 36% increase in “strongly agree” responses, again implying a shift in degree of comfort with faculty.

Students report being slightly less comfortable talking with faculty about school problems (second question in the table) than addressing questions about their field of study. This is also the only question where the number of “agree” responses did not decrease. However, the proportion of “strongly agree” jumped from 25% to 52%, and the proportion who did not agree with the statement decreased from 35% to 8%. Overall, there was a shift from 65% positive responses at pre-STEP to 92% positive responses post-STEP.

The lowest number of initial negative responses were for the statement “I feel like faculty members in my major generally want to see me succeed,” with only 6% of students disagreeing. This decreased to 3% by the end-of-year survey, which combined with a 12 percentage point decrease in “agree” responses to create a 15 percentage point increase in “strongly agree” replies.

Students also generally felt that administrative staff were helpful in the initial survey, with only 9% disagreeing. By the end-of-year, 94% of students agreed, with a 13 percentage point increase in “strongly agree” responses.

The results from this table address the first research question above ((i) Do students who participate in STEP report improved support from mentors?). It is clear from the statistics in this table that STEP students are reporting improved support from both faculty and staff.

4.3 Connections with Other Students: All Cohorts

Students were asked to complete a series of questions to assess any changes in their

connections with other students over time. Each question asked students to respond with how many students they had a connection with. Students reported higher levels of comfort and connection with other students in their majors after participation in STEP. The overall trend for all cohorts was an increase in connections with other students, even though the individual responses varied. Students met many new classmates in their major after participation in STEP. Students generally reported having more friends within their major at the end of STEP. The results for all years combined are also statistically significant for each question.

Students also reported higher rates of socialization with students in their major, higher rates of collaborative studying, and a higher degree of comfort talking about problems with classmates. Most of these changes were fueled by decreases in the number of “0” and “1” responses, while “2-3” responses were generally more consistent. There were generally increases in the “4-10” category, although there were some questions where “2-3” or “>10” increased instead. Most notably, the number of students who reported knowing between 4 and 10 students in their major (first question) decreased from the pre-STEP to the post-STEP survey, in part due to the 26 point increase in the “>10” replies.

Most of the positive change with the question “How many students from your major would you be comfortable talking to about any problems you were having at school?” occurred in the “2-3” response. The results from this table address the second research question above ((ii) Are interactions between STEP students improved throughout the participation in the program?). It is clear from the statistics in this table that STEP students are reporting improved interactions with other STEP students as they go through this program.

4.4 Experiences as a Student in Engineering: All Cohorts

In this section of the survey, we asked students questions regarding their experiences within their major and their feelings about their coursework. Students across all years had generally positive academic experiences and expectations even before participating in STEP. Students largely had the same level of expectation to pass future coursework, the same level of expectation to

graduate with a degree in their major, and the same success in passing coursework at the pre-STEP survey as at the post-STEP, though there was a slight increase in the proportion of students who disagreed with these statements.

There were generally higher levels of positive responses to having passed all coursework and enjoying coursework, and generally lower levels of positive responses among all students to finding the coursework stressful, enjoying coursework, or finding the coursework difficult. The largest shift was a 5% increase of “strongly agree” or “agree” responses to the statement “The courses in my major are stressful.” Only the questions regarding the difficulty and stress level of coursework were statistically significant, with more students agreeing with these statements after participation in STEP. The reason behind the increase in negativity in the stress, difficulty and enjoyment questions has to do with the fact that for the STEP students, the STEP year represents their first true year of delving into their rigorous engineering/computer science majors instead of general education courses and hence the feeling of a tough major.

4.5 Interests, Education and Career Goals: All Cohorts

We also asked students about their interests, education, and career goals both prior to their participation in STEP and again at the end of the year. This section included questions regarding students’ feelings about their field of study and future career/educational prospects.

Students across all cohorts who have participated in STEP felt positive about their field and career prospects. There were several significant differences between pre- and post-survey responses when responses from all the STEP years were combined. Students still agreed at the end of the year, but a little less intensely than at the beginning, that they were excited about pursuing a career in their field, that they would pursue an internship, and that they would pursue research opportunities in their field. Although only by a few percentage points, there was an overall decline in the proportion of “strongly agree” responses to several of these questions, no change at all or slight increase.

When examining all STEP students, the highest proportion disagreed with the statement related to whether they intend to attend graduate school, with a negligible difference over time. Still about 80% of student are thinking, as mostly sophomores, of going to graduate school! That by itself is a good contribution to the data in this field of interest, i.e. the field of graduate school interest, upon which universities can plan.

4.6 Change Attributed to STEP program: All Cohorts

In order to understand the influence of STEP on participants, we asked students several questions about their confidence in the major, career goals, and networking. Like prior questions, this included a series of statements with responses ranging from “strongly agree” to “strongly disagree.”

The vast majority of students agreed that STEP made them more confident about their field of study and career goals. Further, most agree that they met other students and faculty. Nearly 40-50% or more “strongly agreed” with each of these statements. The vast majority of students reported that they benefitted from STEP in all the ways listed. Most notable is that nearly half of the students strongly agree that they have more support from faculty. Again, the responses to all four questions are significantly different from their hypothesized value. The results from this table address the third research question above ((iii) Are students who participate in STEP likely to remain in Engineering?). It is clear from the statistics in this table that STEP students overwhelmingly report confidence in their field of study and in their career direction as a result of their participation in the STEP program.

4.7 The Fifth and Sixth Mentoring Sessions

We asked students a series of questions designed to gauge their perceptions about the quality and utility of the Fifth and Sixth (last) mentoring sessions. The Fifth mentoring session was a large group session that included all of the STEP participants. A majority of students who completed the survey did attend the fifth session.

4.7.1 Interactions during fifth mentoring session: All cohorts

The fifth mentoring session was a large group session that included a presentation on interview tips. It was always a representative from UNM's Career Services who gave the presentation. Students had an opportunity to interact with fellow students, mentors, and company representatives at the fifth session, and most students reported that they did so. The proportion of students in the 2018 who reported that it was "definitely true" that they interacted with fellow students, mentors, and/or company representatives is higher than the proportion for all cohorts. Further, all of the students in the 2018 cohort reported that it was at least "somewhat true" that they interacted with fellow students. Relative to other cohort years, a smaller percentage of students from the 2018 cohort reported that they did not interact with either mentors or company representatives compared to STEP students overall. The authors believe that such improvement in the response over time in the program is due to the organizers gaining yearly experience with better management and planning of events compared to the first years when a high-learning curve existed for the organizers.

4.7.2 Perceptions of the sixth mentoring session: All cohorts

The final mentoring session in the 2018-2019 year was a large group session with a presenter from NASA, hosted by the School of Engineering as part of their Professional Engineer Speaker Series. This format differed from prior years where there were multiple smaller group meetings, with a variety of speakers from different companies targeting specific majors.

Twenty-nine (66%) of the 2018 students who completed the end-of-year survey indicated that they attended the last (sixth) mentoring session. Of the respondents who attended the session, almost all of them indicated that the presenter(s) spoke clearly (97%) and that the presenter(s) was/were enthusiastic (93%). In addition, the students almost unanimously agreed that the presentation(s) was/were useful (96%). Similarly, 100% of respondents from the 2018 cohort agreed that they had learned about the presenter's company and/or agency. The results from the 2018 cohort are similar to those from previous cohorts, i.e. being mostly positive.

4.8 Benefits of STEP Participation

We provided students with a checklist of the ways in which they may have benefitted from their participation in STEP, and asked the students to mark all that applied. The benefits most frequently reported by students from the 2018 cohort were networking with faculty and increased knowledge of department. These were followed by increased confidence in career path, received career advice, and improved personal skills/personal growth. Slightly more than one third of students responded that they did receive "other" benefits; five of those students did not explain what those benefits were. In addition, many students wrote additional comments even though they did not indicate receiving 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.

For the sake of comparison, we have included response from previous cohorts. A greater proportion of STEP students indicated they received benefits in many categories relative to all STEP students. Particularly notable is the larger proportion of 2018 students who indicated their job skills improved and that they networked with students.

4.9 Summer Internships

We asked students if they obtained a summer internship through STEP. At least 58% of the students in any cohort year have gotten an internship! This is a pretty successful outcome for the program. Moreover, most students (at least 67%) thought that the STEP program will help them land an internship in the future. This is another welcome outcome for the program.

4.10 Student Comments about STEP

Finally, we asked students if there was anything they would like to share about their experiences with the STEP program. Some received comments are the following:

“Really helpful program and hopefully more students can benefit from it in the future.”

Another student stated:

“[STEP] was very fun, educational, and I would definitely recommend it to other students.”

Several students expressed gratitude for their STEP participation. For example, one student said:

“Thank you so much for everything the STEP staff does for the students. I really appreciate all the support that goes into all the STEP students.”

Some students noted that they think the program should continue. For example, one student wrote:

“Please don’t lose this program, it is one of the best things we have here.”

Several students spoke of the opportunities their participation in STEP afforded them. While many different opportunities were discussed, the comments seemed to give special attention to

internships. One student said *“Thank you! Without [STEP] I don’t think I would have received [an internship].”* Other opportunities were also discussed. For example, one student expressed gratitude for the opportunity to *“participate with and learn from the STEP students and mentors.”* And another wrote:

“I think that this is a great program that really does aim to help students. From getting internships, interviewing techniques, and doing well in school, the program was very helpful.”

Students also expressed their appreciation of other components of the STEP program. Some students discussed how STEP helped them become more confident about entering the workforce in engineering. Several students also discussed the networking opportunities the STEP program provided, such as one student who said *“[STEP] was an amazing opportunity, to seek and build a professional network with other future engineers and faculty of the many different engineering departments.”* All the comments are categorized in Table 10.

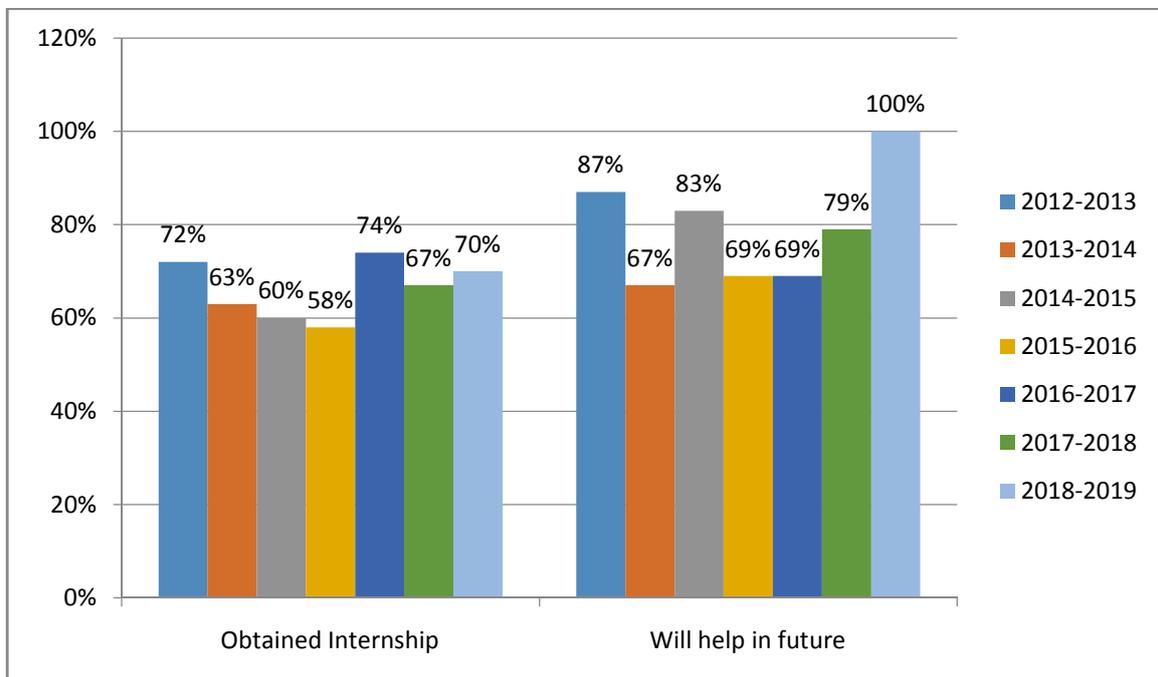


Fig. 1. Summer internship

**2012, 2014 and 2018 cohort years significantly higher for “Will help in future”*

Table 1. Major by cohort

		2011	2012	2013	2014	2015	2016	2017	2018
Mechanical engineering	Pre-survey	21.5%	29%	33%	22%	30%	19%	18%	13%
	End-of-year survey	20%	29%	30%	22%	30%	18.5%	17%	11%
Chemical/biochemical engineering	Pre-survey	21.5%	14%	21%	20%	22%	28%	30%	32%
	End-of-year survey	18%	14%	24%	20%	22%	29%	29%	30%
Computer science	Pre-survey	13%	12%	11%	24%	20%	11%	16%	15%
	End-of-year survey	8%	12%	10%	24%	20%	10.5%	15%	14%
Electrical engineering	Pre-survey	6%	23%	10%	14%	9%	15%	2.5%	15%
	End-of-year survey	10%	23%	9%	14%	9%	14%	3%	17%
Computer engineering	Pre-survey	7%	2%	8%	5%	7%	2%	6.5%	4%
	End-of-year survey	10%	2%	9%	5%	7%	2%	9%	5%
Civil engineering	Pre-survey	13%	8%	10%	11%	4%	6%	12%	9%
	End-of-year survey	15%	8%	9%	11%	4%	8%	12%	9%
Nuclear engineering	Pre-survey	18%	12%	7%	3%	7%	17%	12%	12%
	End-of-year survey	19%	12%	9%	3%	7%	18%	12%	14%
Non-engineering	Pre-survey	0%	0%	0%	1%	1%	0%	3%	0%
	End-of-year survey	0%	0%	0%	1%	1%	0%	3%	0%
N	Pre-survey	67	49	61	76	77	46	57	53
	End-of-year survey	51	52	67	76	77	49	59	44

Source: Field Survey

Table 2. All years support of faculty and staff

		Strongly Agree	Agree	Disagree	Strongly Disagree	N
I know one or more faculty members I can talk with if I have questions about my field of study*	Pre-survey	29%	46%	21%	4%	443
	End-of-year survey	65%	33%	1.5%	<1%	
I know at least one faculty member I can talk with if I am having problems with school*	Pre-survey	25%	40%	29%	6%	443
	End-of-year survey	52%	40%	7%	1%	
I feel like the faculty members in my major generally want to see me succeed*	Pre-survey	42%	53%	4.5%	0.5%	441
	End-of-year survey	57%	41%	1.5%	0.5%	
The administrative staff in my major department are helpful*	Pre-survey	37%	55%	6.5%	1.5%	442
	End-of-year survey	50%	44%	5%	1%	

*Statistically significant difference between pre-survey and end-of-year survey. Source: Field Survey

Table 3. All years connections with other students

		0	1	2–3	4–10	>10	N
How many students do you know in your major? *	Pre-survey	5%	6%	25%	50%	15%	425
	End-of-year survey	1%	3%	13%	42%	41%	
How many students from your major would you feel comfortable asking for help with coursework? *	Pre-survey	14%	15%	43%	24%	5%	435
	End-of-year survey	5%	9%	37%	38%	11%	
How many students from your major do you consider your friends? *	Pre-survey	24%	17%	43%	14%	2%	437
	End-of-year survey	11%	12%	40%	28%	9%	
How many students from your major would you be comfortable talking to about any problems you were having at school?*	Pre-survey	27%	20%	39%	12%	2%	437
	End-of-year survey	14%	17%	47%	17%	6%	
How many students from your major do you socialize with regularly? *	Pre-survey	32%	17%	35%	14%	2%	435
	End-of-year survey	19%	11%	36%	27%	8%	
How many students from your major do you regularly study with? *	Pre-survey	34%	18%	39%	10%	<1%	438
	End-of-year survey	18%	10%	42%	26%	4%	

**Statistically significant difference. Source: Field Survey*

Table 4. All years experiences as a student

		Strongly Agree	Agree	Disagree	Strongly Disagree	N
I have passed all of the coursework in my major so far	Pre-survey	59%	33%	8%	0%	439
	End-of-year survey	59%	32%	8%	1%	
I expect to pass future coursework in my major	Pre-survey	63%	37%	1%	0%	440
	End-of-year survey	64%	35%	1%	1%	
The coursework in my major is difficult*	Pre-survey	38%	56%	6%	0%	440
	End-of-year survey	49%	48%	3%	1%	
The courses in my major are stressful*	Pre-survey	36%	51%	13%	1%	440
	End-of-year survey	44%	48%	7%	<1%	
I enjoy the coursework in my major	Pre-survey	44%	53%	3%	1%	439
	End-of-year survey	42%	52%	6%	<1%	
I will graduate with a degree in my major	Pre-survey	79%	21%	0%	0%	440
	End-of-year survey	76%	24%	<1%	1%	

**Statistically significant difference. Source: Field Survey*

Table 5. All years interests, education, and career goals

		Strongly Agree	Agree	Disagree	Strongly Disagree	N
I am excited about pursuing a career in my major field*	Pre-survey	78%	22%	1%	0%	438
	End-of-year survey	73%	25%	1%	<1%	
There are a lot of opportunities for interesting work in my major field	Pre-survey	77%	22%	1%	0%	437
	End-of-year survey	75%	24%	<1%	1%	
I am really interested in engineering and/or computer science	Pre-survey	66%	29%	5%	1%	437
	End-of-year survey	69%	28%	3%	1%	
I intend to pursue an internship related to my major field*	Pre-survey	82%	17%	1%	0%	437
	End-of-year survey	76%	23%	1%	<1%	
I am likely to get a job in my field once I finish with my schooling	Pre-survey	56%	40%	3%	<1%	437
	End-of-year survey	56%	40%	3%	1%	
I feel confident about my ability to do well in my chosen field	Pre-survey	51%	44%	5%	0%	435
	End-of-year survey	52%	43%	5%	<1%	
My major coursework will prepare me to work in my field	Pre-survey	47%	48%	4%	<1%	436
	End-of-year survey	47%	49%	3%	1%	
I intend to pursue research opportunities in my field*	Pre-survey	58%	35%	8%	0%	437
	End-of-year survey	52%	36%	10%	1%	
I am likely to pursue a graduate degree in my major	Pre-survey	38%	43%	18%	1%	437
	End-of-year survey	40%	40%	18%	2%	
I intend to attend professional development conferences in my field	Pre-survey	50%	43%	7%	0%	437
	End-of-year survey	45%	46%	7%	1%	

*Statistically significant difference. Source: Field Survey

Table 6. All years changes attributed to STEP

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. Source: Field Survey

Table 7. Interactions at fifth mentoring session

		Definitely true	Mostly true	Somewhat true	Not at all true	N
I interacted with fellow students at this session	2018	49%	33%	18%	0%	39
	All years	40%	32%	23%	5%	340
I interacted with mentors	2018	44%	26%	26%	5%	39
	All years	31%	30%	28%	11%	340
I interacted with company representatives	2018	39%	18%	36%	8%	39
	All years	25%	25%	29%	21%	340

Source: Field survey

Table 8. Perceptions of the presentation(s) by industry speaker(s)

		Strongly agree	Agree	Disagree	Strongly disagree	N
The presenter(s) spoke clearly	2018	62%	35%	3%	0%	29
	All years	61%	33%	4%	3%	316
The presenter(s) was/were enthusiastic	2018	55%	38%	7%	0%	29
	All years	57%	35%	5%	3%	316
The presentation(s) was/were useful	2018	55%	41%	0%	4%	29
	All years	48%	40%	7%	4%	312
I learned about my field and/or the industry from this presentation/these presentations	2018	48%	31%	17%	4%	29
	All years	47%	36%	11%	6%	315
I learned about the presenter's company and/or agency	2018	69%	31%	0%	0%	29
	All years	54%	41%	2%	3%	315

Source: Field Survey

Table 9. How students benefitted from STEP program

	2013	2014	2015	2016	2017	2018	All years
Internship opportunities	87%	92%	79%	89%	87%	91%	87%
Increased confidence in career path	85%	90%	79%	82%	89%	93%	86%
Received career advice	83%	90%	83%	80%	91%	93%	87%
Increased knowledge about scholarship opportunities	75%	89%	81%	82%	78%	75%	80%
Networking with professionals in field	78%	89%	73%	78%	87%	89%	82%
Networking with faculty	80%	84%	82%	89%	89%	96%	86%
Improved personal skills/personal growth	76%	83%	74%	84%	82%	93%	81%
Increased knowledge of department	80%	82%	84%	89%	87%	96%	86%
Increased understanding of field	78%	79%	81%	84%	86%	91%	82%
Networking with students	65%	78%	75%	73%	91%	91%	78%
Academic guidance	67%	78%	66%	80%	78%	84%	75%
Improved job skills	70%	75%	75%	78%	82%	91%	78%
Opportunities to attend conferences	60%	67%	75%	87%	89%	73%	74%
Improved academic skills	42%	54%	47%	69%	60%	68%	55%
Other	30%	35%	23%	40%	27%	34%	31%
N	60	73	76	45	55	44	354

Source: Field Survey

Table 10. Student Comments about STEP

	2013	2014	2015	2016	2017	2018	Total
General positive comments	42%	38%	37%	37%	20%	20%	34%
Components	18%	21%	4%	14%	5%	10%	12%
Gratitude	10%	19%	20%	16%	8%	15%	15%
Appreciate individuals	6%	0%	0%	8%	3%	2%	3%
Increased knowledge	0%	6%	3%	6%	5%	5%	4%
Encourage/recommend others to participate	0%	5%	3%	4%	3%	5%	3%
Led to other opportunities	3%	1%	0%	0%	13%	17%	4%
Want to participate again	0%	3%	0%	2%	3%	0%	1%
Suggestions for improvement/ dissatisfied	15%	6%	12%	8%	23%	5%	11%
Other	5%	0%	9%	0%	3%	5%	4%
Nothing to add	0%	0%	12%	6%	18%	17%	8%
N	60	63	75	51	40	41	330

Source: Field Survey

5. CONCLUSIONS

Regardless of cohort, the vast majority of students indicated that due to their participation in STEP, they felt more supported by faculty. All cohorts report knowing more students and report a greater degree of interaction after STEP. Overall, 86% of students report meeting other students due to their participation in STEP.

Most students were positive about their coursework, their experiences as engineering students, and optimistic about their future employment. However, the percentage of students viewing their coursework as difficult and stressful increased over the span of a year. This likely reflects the increased level of difficulty of the courses that students encounter as they progress through their academic programs. Further, over 86% of students overall reported that because of STEP, they felt more sure about their field of study and career goals.

Students reflected positively on their experiences at the large mentoring sessions delivering career tips. In both sessions (second and fifth), students indicated that the presenters spoke clearly, were enthusiastic, and that the information was useful. Students in the cohorts reported interacting more often with fellow students, mentors and company representatives.

The proportion of students who obtained an internship has varied over time from a low of 58% in 2015 to a high of 74% in 2016. Most students who have participated in STEP over the years reported that they thought STEP would help them get an internship in the future.

Overall, students in all cohorts expressed a belief that STEP had benefitted them personally. Students often offer praise and appreciation for the program.

In summary, these results suggest that the STEP program has met many of the short-term outcomes identified. Students report increased engagement with faculty members and other students in their departments. The objective of increasing students' ties to their departments and to the institution can be realized through these personal connections.

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COMPETING INTERESTS

Authors have declared that no competing interests exist.

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