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A Study of Internships and Conferences on Retention and Graduation of Undergraduate Students

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Abstract: The issue of retention and graduation of STEM college students is an important one in the United States, which the federal government, and its agencies, have focused on addressing for many years. In this paper, the authors discuss the experiences of a National Science Foundation STEP (STEM Talent Expansion Program) award to the School of Engineering at the University of New Mexico (UNM). The objective of this project is in-line with the national goal of improving retention and graduation rates of STEM students (specifically engineering and computer science students). The setup of this STEP project is unique in the sense that it focuses its efforts and activity funding on internships and professional conference participation trips for early career engineering and computer science students. In addition to a background on the national STEP Program, the paper discusses the constructive elements of this project and the data that was collected to measure its impact. The methods of this research involved data collection and analysis, surveys, bivariate descriptive statistics with statistical significance, and multivariate logistic regression analysis. The findings supported the original hypothesis of this multi-year study concerning the anticipated positive effect internships and conference participations can have on the graduation and retention of engineering undergraduate students. Therefore, it is concluded that such activities be explored at other higher education institutions in order to improve their retention and graduation numbers.

Keywords: Career Development, Computer Science, Engineering, Internships, Mentoring, STEM, STEP, Retention, Undergraduates

1. Introduction

The Science, Technology, Engineering, and Mathematics (STEM) Talent Expansion Program (STEP) seeks to increase the number of students (U.S. Citizens or permanent residents) receiving associate or baccalaureate degrees in established or emerging fields within science, technology, engineering, and mathematics (STEM). The National STEP Program was funded by the National Science Foundation (NSF) for many years, but has recently (2014) been archived and merged, along with two other programs, into the new Improving Undergraduate STEM Education (IUSE) Program. This increase in the number of such students is believed to be a direct result of improved retention and graduation rates as per the Program RFP/description. The STEP Program was distinguished from other programs funded by the NSF Directorate of Education and Human Resources (EHR) by a few collective things. First, it was a large award of up to 2 million dollars for five years. Second, the Program sought to induce permanent institutional change facilitated by this relatively large funding amount. Therefore, sustainability efforts were an important aspect of any STEP project. Third, the Program asked all projects to anticipate the actual improvements in retention and graduation rates as a result of implementation of their project. Fourth, the funding would be provided for the first three years whereas the last two year's funding would only be released after satisfactory progress towards the project in the previous years (and as certified by a NSF Panel following a third-year review process). Fifth,

focus should be on early career students (freshmen and sophomores). Sixth, the implementation of an internal review board/committee, along with an external one, was important mandatory pieces of any project.

The UNM (University of New Mexico) STEP Project was proposed in 2010, and the actual funding for the project came in towards the end of 2011. The actual start of the project in earnest was during the Spring 2012 semester. The 5-year, 2 million dollar Project involves the UNM School of Engineering (SOE), which is composed of four engineering departments (Civil, Mechanical, Electrical, and Chemical/Nuclear) and the Computer Science department. This Project revolves around the main goals of the National STEP Program, and has the following main four components: Mentoring, Internships, Targeted Retention Activities (e.g., conferences), and Incentives (e.g., a second internship).

The UNM STEP program funneled most of its funding into internships and conferences in order to achieve the stated goals of graduation and retention. The current project evaluates the experiences of students within this program that are theorized to be related to retention and graduation. Specifically, we set out to answer the following questions: (1) Do students who participate in STEP report improved support from mentors? (2) Are interactions between STEP students improved throughout the participation in the program? (3) Are students who participate in STEP more likely to remain in Engineering relative to similarly situated students who did not participate in STEP? (4) Are students who participate in STEP more likely to graduate relative to similarly situated students? (5) To what extent do students report a positive internship experience and in what ways? In the following section, we discuss how mentorship, peer relationships, conferences, and internships are related to retention and graduation.

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

1) 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 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.

2) Internships: there are 75 funded internships/year allotted for during 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.

3) Targeted Retention Activities: there are 75 funded professional conference participations provided per year.

4) 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-major (i.e. not enrolled in an engineering/CS major yet).

UNM is in the unique position to be a Research I university (i.e. research-intensive), while also being a Minority Institution (MI) and a Hispanic-Serving Institution (HSI), one of only two such universities in the USA. Because of this fact, a goal of this program is to engage the minority and female students of UNM's SOE in the STEP project. Furthermore, 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.

2. Literature Review

The National Science Foundation reports that 56% of students who began with a major in engineering in 2004 remained in the engineering program after five years. This is lower than persistence in social and behavioral sciences (61%) and non-science/engineering majors (79%), but higher than some other science fields, including physical, math, and computer sciences (43%) and biological and agricultural sciences (54%) [1]. 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].

Despite these gains, data indicate that some students are still less likely than others to major in and/or complete a degree in engineering. While the rate at which women earned bachelor's degrees awarded in 2011 exceeded males (57% to 43%, respectively) in general, women were much less likely to earn a degree in engineering. Among all students who earned a bachelor's degree in engineering in 2011, just 19% were awarded to women [1]. Other groups have been identified as being more at risk of dropping out. For example, lower income students are less likely to earn a college degree within six years compared to high-income students [6]. Furthermore, minorities are disproportionately less likely to earn a bachelor's degree [1]. Recognizing the lack of diversity in the workforce, there has been a push by both the National Science Foundation and academic institutions to increase recruitment and retention of students from a variety of backgrounds into engineering fields.

Studies indicate that undergraduate retention is related to a variety of factors, both individual and institutional. Individual factors 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 can all influence persistence in earning engineering degrees [5, 7, 8]. Institutional factors include teaching quality, faculty-student relationships, academic support services, financial support, and opportunities for professional development among other characteristics [8, 9]. Tinto argued that students who are not engaged in the institution academically and socially are more likely to drop out, and that both the individual and the institution play a role [5]. Furthermore, early and strong integration into the institution has been associated with increased retention [10]. In the sections that follow, we discuss the roles of self-efficacy, institutional integration, and career development in student retention.

2.1. Self-Efficacy

Self-efficacy refers to perceived self-confidence or level of competence [11]. The literature has identified a variety of types of self-efficacy, which have been measured in numerous ways, and have found that self-efficacy is strongly associated with both retention in academic institutions and careers in engineering [12]. The literature focuses especially on academic self-efficacy (confidence and competence to successfully complete the academic work required), and professional or job-related self-efficacy (e.g., see [11, 13]). Self-efficacy can bolster commitment to academic and career-related goals. Notably, Moller-Wong et al. [8] argue that commitment to personal goals is the most important determinant of persistence.

Self-efficacy is dynamic and can be influenced by a variety of factors. For example, academic self-efficacy has been shown to be related to prior academic achievement (e.g., high school GPA and SAT/ACT scores), sex (with females typically expressing lower academic self-efficacy), and experience (see [11]). Course difficulty or failure can lower academic self-efficacy, leading to dropping out of engineering [5].

Studies have found that academic self-efficacy is strongly related to retention. For example, in their longitudinal study of engineering students from four universities, Raelin et al. [11] found that academic self-efficacy along with contextual support are important for retention. 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, 14]. Furthermore, professional role confidence and work self-efficacy are related to retention [11, 13]. These can be bolstered through mentorship (including discussing role expectations), professional socialization experiences, and real world learning experiences, such as internships [11, 13, 15].

2.2. Institutional Integration

Tinto explains that effective retention efforts are comprised of three principles. Besides institutional commitment to students and their success, as well as educating all of its students, Tinto argues that effective retention programs develop supportive social and educational communities [16]. In other words, 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 year of college.

2.2.1. Mentoring

Mentoring can be a key component to fostering institutional engagement. 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]. For example, one program that combined mentoring with research experiences and targeted academic interventions was successful in increasing retention and graduation rates among those most at risk for dropping out [18]. Conversely, lack of effective mentoring and advising can be factors that lead to students dropping out [5].

Mentoring programs range from very structured to informal [16]. While mentoring is expected to be beneficial, the extent of the impact may differ depending on a variety of factors including the genders of the parties involved, the type of mentoring, how individuals communicate, how frequently they communicate, and the cultural background of the parties involved [17, 19]. Regardless, successful mentoring programs share some important key objectives. These include increasing the student's feelings of support, providing positive role models, and providing the student with academic and career advice with the intent of increasing retention and graduation. Positive interactions with faculty through formal or informal mentoring are expected to facilitate retention.

2.2.2. Other Methods of Increasing Institutional Engagement

Students who have social ties to their institution are thought to be less likely to drop out [16]. Besides mentoring, there are other important ways that students and institutions can strengthen students' social and academic engagement. Students may engage in student organizations, on-campus or campus-related recreational events and activities, utilize campus support resources such as tutoring services, and engage in other formal or informal activities. These can all serve to increase institutional engagement. Indeed, Meyer and Marx [5] argue that students who feel "comfortable and accepted" are less likely to drop out.

2.3. Career Development Through Internships

As noted previously, self-efficacy is an important component of engineering student retention and graduation. Career development may be fostered through activities such as internships, cooperative education, research experiences or exposure to the professional community, and can influence

both academic and professional self-efficacy. Here we focus particularly on internships.

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 [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 as well [11, 20]. Internships can also be a crucial component when it comes to developing an identity as an engineer [15].

Internships may also be helpful to students who need additional financial assistance. This can be especially significant for lower income students who are likely to work off campus. Studies indicate that students who work off campus are less likely to complete their degrees, with the risk of dropping out increasing with the number of hours worked [5, 21]. Due to the very structured nature of engineering programs, work can greatly interfere with successful and timely completion of the engineering degree, and can lead to a greater disconnect between students and the institution [21]. Internships may provide students with financial assistance, while also keeping them on track and connected to the engineering department. However, it should be noted that the pay provided through internships may not be enough to cover the need that lower-income students have [21].

3. Methodology

3.1. Institution and Program Background

UNM is in the unique position of being a Research I university (i.e. research-intensive), while also being a minority institution (MI) and a Hispanic-Serving Institution (HSI), one of only two such universities in the USA. Because of this fact, a goal of the STEP program at UNM is to engage the minority and female students of UNM's SOE. Furthermore, 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.

3.2. Participants and Comparison Group

The criteria for participation in STEP changed overtime in conjunction with varying levels of participants (n=69 to n=143). Initially, the program targeted students who were in their first year of Engineering, typically sophomores at the University. In 2014 the STEP program at UNM expanded to allow students who were less advanced in their college careers to participate, and then in 2017 students who were further along in their academic careers were allowed to participate. Throughout this report, "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.

The timing of the construction of the comparison 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. Thus, these cohorts of the comparison group could include students who subsequently dropped out of the School of Engineering (SOE). Conversely, the cohorts constructed from 2015 to 2017 were constructed retrospectively, in the spring of 2018, using a pool of students who were in the SOE. Therefore, these cohorts included only those who were still in the SOE at the time the list of potential comparison group members was pulled in 2018, meaning that students who left the SOE prior to that were not included in these cohort comparison groups.

3.3. Data Collection

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. 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. This ethics of this project were approved by the Office of the Institutional Review Board (OIRB) at UNM. Informed consent to participate in the survey was obtained from each participant.

3.4. Data Analysis

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 cohort comparison group where appropriate.

3.5. Research Team

The Principal Investigator (PI) of the UNM STEP Project is also the first author of this paper. There are a total of five PIs, one from each SOE department. There is also a full-time coordinator for the Project. The second author is the evaluator for the Project, who is involved in assessment activities throughout the year.

4. Results and Discussion

Throughout this project, a large number of data were collected to monitor the project's progress, and to implement programmatic changes based on feedback throughout its course. Specifically, both qualitative and quantitative types of data were collected. In the following sections, we present and discuss a select number of such data to illustrate the effect of project activities, as seen formally during the evaluation process.

Before presenting the data on mentoring and internships/conferences, we present the student data on gender, ethnicity, age, GPA, etc.

Table 1. *Unm step students/participation by academic major.*

Major	2011-12	2012-13	2013-14	2014-15	2015-16
Chemical Engineering	14	10	27	35	24
Nuclear Engineering	10	8	5	5	9
Mechanical Engineering	14	22	24	25	44
Computer Engineering	6	2	7	8	16
Computer Science	6	2	7	8	16
Electrical Engineering	7	12	7	17	15
Civil Engineering	9	4	6	11	6
TOTAL	69	70	84	137	143

The data in Table 1 reflect the number distribution for STEP students by major. The distribution parallels the number of student enrollees in each major (i.e. correlates with it). For example, majors that have high undergraduate student enrollment rates, like Mechanical Engineering, have a relatively high number of students participating in STEP. However, this is not always the case, as Electrical Engineering has a large number of enrolled undergraduate students, but the STEP participation was relatively low for this major. The amount of effort that faculty and staff put into encouraging students to participate in the STEP program could be one explanation as to why there was higher participation coming from some majors relative to others (examples are Chemical Engineering and Computer Science).

Table 2. *Ethnicity and race of step students over the years.*

	2011-12	2012-13	2013-14	2014-15	2015-16
White	42%	56%	50%	50%	47%
Hispanic	23%	24%	26%	28%	30%
Asian	9%	8%	6%	8%	13%
American Indian	7%	3%	7%	7%	4%
African American	1%	6%	4%	3%	3%
Non-Specified	18%	3%	7%	4%	3%

In Table 2, the race and ethnicity percentages reflect UNM's status as a MI and a HSI. These percentages closely parallel those found for the University at-large, i.e. about half the undergraduate student population is white, followed second by the Hispanic student percentage.

Table 3. *Age, GPA, and Gender of Step participants over the years.*

	2011-12	2012-13	2013-14	2014-15	2015-16
Age Range	17-44	18-41	18-50	17-49	18-45
Average Age	24	23	23	22	23
GPA Range	2.2-4.3	2.3-4.3	2.1-4.2	2.0-4.2	2.2-4.3
Average GPA	3.4	3.3	3.5	3.4	3.3
Gender	M=48	M=53	M=63	M=96	M=106
	F=21	F=17	F=21	F=41	F=29

Table 3 shows the wide range of ages and GPAs of student participants in the UNM STEP program. The wide range could be due in part to UNM's share of non-traditional students. However, the younger average age for each cohort is representative of the focus of the STEP program on early career students. In regards to GPA range, students from each cohort tend to range from "C" averages to "A" averages, with the overall average being somewhere in the middle. This is not surprising considering that the National STEP Program is not an elitist program, in the sense that it tries to cast as wide a net as possible rather than focusing solely on academic talent unlike several other NSF EHR programs. The gender ratios for these cohorts, calculated as the percentage of female to male students, are quite interesting. This ratio at one point (2011-12) was as high as 44%, while the typical percentage of female students in the UNM SOE is about 15%. This finding suggests that the STEP Program may be more attractive to female engineering students compared to their male counterparts.

4.1. Mentoring and Student Interaction

We begin by describing changes in perceived support from faculty and student-to-student interaction. First off, we present student survey results from the 2013-2014 academic year (an exemplary year). Specifically, in Table 4 we compare the preliminary survey (i.e. "Pre-survey") taken by STEP students at the start of the Fall semester and before starting any STEP activities. Students take the "End of semester survey" after finishing three mentoring sessions in the Fall semester. The "End of year survey" is completed after the end of six mentoring sessions and before the start of the summer internship. Eighty-four (84) students were invited to participate in the "End of year survey." Sixty-nine (69) students accessed the survey and 68 (81%) completed it. Table 4 shows the support from faculty and staff as perceived by the STEP students.

During the first five STEP sessions, faculty members are supposed to engage with the STEP students in a mentoring capacity; this includes helping them academically and beyond in order to make their transition into Engineering/CS better, in

part by helping students to feel more connected to their department and major.

Table 4. *Support from Faculty and Staff Members as Perceived by the Step Students.*

		Strongly agree	Agree	Disagree	Strongly disagree
I know one or more faculty members I can talk with if I have questions about my field of study[a,b,c]	Pre-survey	13%	55%	27%	5%
	End of semester survey	40%	47%	12%	2%
	End of year survey	58%	42%	0%	0%
I know at least one faculty member I can talk with if I am having problems with school[a,b,c]	Pre-survey	10%	42%	38%	10%
	End of semester survey	32%	40%	27%	2%
	End of year survey	47%	43%	8%	2%
I feel like the faculty members in my major generally want to see me succeed[b,c]	Pre-survey	32%	65%	3%	0%
	End of semester survey	38%	48%	12%	2%
	End of year survey	52%	45%	3%	0%
The administrative staff in my major department are helpful	Pre-survey	30%	58%	10%	2%
	End of semester survey	42%	48%	8%	2%
	End of year survey	40%	48%	8%	3%

a indicates statistically significant ($p < .05$) results comparing pre-survey to end of semester survey.
b indicates statistically significant ($p < .05$) results comparing end of semester survey to end of year survey.
c indicates statistically significant ($p < .05$) results comparing pre-survey to end of year survey.

As exemplary Table 4 shows, student perceptions of faculty and staff support generally increase over time, particularly between the pre-program survey and the end of the semester survey. Specifically, the proportion of students who indicate that they DISAGREE with each statement decreases, while the proportion that STRONGLY AGREE increases. This table demonstrates the general satisfaction that students feel about the support they are receiving from faculty and staff during the STEP year. The superscripts in the first column indicate statistically significant differences ($p<0.05$) in the response percentages. From this table, the results of which are generally repeated year to year, we can infer that the STEP project is performing satisfactorily in this aspect of enhancing professor-student or staff-student relationships/interactions. In accordance with the previous references (e.g. [16]), this mentoring provided by the UNM STEP faculty members bodes well for increasing the students' satisfaction and their retention and graduation.

Another goal of the UNM STEP Project is to increase the interaction of students with their peers, which is expected to further institutional integration. Attempts to achieve this goal are primarily facilitated through the group settings provided by this Project, which give students the opportunity to interact with one another.

Table 5. *Interaction Between Step Students.*

		NONE	ONE	TWO TO THREE	FOUR TO TEN	MORE THAN TEN
How many students do you know in your major?[+]	Pre-survey	12%	3%	23%	49%	13%
	End of year survey	2%	2%	8%	38%	51%
How many students from your major would you feel comfortable asking for help with coursework?[+]	Pre-survey	20%	12%	41%	25%	3%
	End of year survey	7%	3%	36%	39%	13%
How many students from your major do you consider your friends?[+]	Pre-survey	34%	10%	39%	16%	0%
	End of year survey	10%	7%	51%	23%	10%
How many students from your major would you be comfortable talking to about any problems you were having at school?[+]	Pre-survey	41%	10%	36%	12%	2%
	End of year survey	15%	12%	53%	13%	7%

[+] indicates statistically significant ($p<.05$) results comparing pre-survey to end of year survey.

Table 5 indicates improved connections between students from the Pre-Survey to the End of the year survey, as measured by the number of students the participants know and the level of engagement with fellow students. All changes were statistically significant ($p \leq .05$). According to Meyer and Marx [5], the data presented in Table 5 would suggest that STEP students are less likely to drop out, as students indicated that they are feeling more comfortable and accepted due to their participation in the STEP Project.

4.2. Retention and Graduation Rates

We assessed retention and graduation rates of STEP students relative to the following comparison group: SOE students from the same cohort years as the STEP students, but who did not participate in the STEP Project for one reason or another. The STEP cohorts are labeled in the following tables as 2011 (standing for the 2011-2012 year), and so forth.

In Table 6, the results show that a higher percentage of students have switched majors in the comparison group compared to the participant group. Students in the comparison group appear to be leaving Engineering at rates that exceed those who participate in the STEP program. Compare this excellent retention rate with the 56% reported by NSF earlier [1]! Note that the 6 semesters include the two

semesters of STEP mentoring, along with the summer semester. The time period of 6 semesters would therefore be equivalent to one full calendar year after the students completed their STEP participation. 9 semesters would actually mean two full calendar years after completing STEP. In other words, we looked at the first two years max after completing STEP.

In addition to students who are in STEP proper, the STEP Project has also offered professional conference opportunities to pre-majors/pre-engineering students. With respect to the effect of professional conference participation trips on retention, a total of 46 pre-engineering/pre-major students attended conferences in 2012-13 and 2013-14. The first group attended a conference during the Fall 2012 semester. Of those 46 students, 38 (83%) have stayed in the School of Engineering into the following Fall semester. Also, 14 such students participated in conferences in 2014-2015, and 13 students stayed on (i.e. 93%). These findings differ strikingly from the official figure of 52% provided by the SOE in the year 2010.

Table 6. *Change in soe major within 6 and 9 semesters.*

Cohort	Changed within 6 semesters	Changed within 9 semesters
2011 participants (69)	1.4% (1)	5.8% (4)
2011 comparison (81)	7.4% (6)*	12.3% (10)
2012 participants (70)	4.3% (3)	5.7% (4)
2012 comparison (81)	12.3% (10)*	13.6% (11)*
2013 participants (83)	4.8% (4)	4.8% (4)
2013 comparison (109)	12.8% (14)**	12.8% (14)**
All 2011 to 2013 participants (222)	3.6% (8)****	5.4% (12)***
All 2011 to 2013 comparison (271)	11.1% (30)	12.9% (35)

Number of students (in parentheses)
****p<.001; ***p<.01; **p<.05; *p<.10

With respect to graduation data, please refer to Table 7. Within 9 semesters, STEP students are graduating at a higher rate than non-STEP students. This finding could be related to differences in GPA and earned credits, which will both be discussed subsequently. As a reminder, improving graduation rates is one of two important goals for the national STEP program, along with improving retention. This data favorably supports this graduation rate goal.

Table 7. *Graduation Data for Step Students and the Comparison Group.*

Cohort	Graduated within 6 semesters	Graduated within 6 semesters with a degree in engineering	Graduated within 9 semesters	Graduated within 9 semesters with a degree in engineering
2011 participants (69)	7.2% (5)	7.2% (5)	72.5% (50)	69.5% (48)
2011 comparison (81)	8.6% (7)	6.2% (5)	69.1% (56)	64.2% (52)
2012 participants (70)	0%	0%	54.2% (38)	51.4% (36)
2012 comparison (81)	12.3% (10)****	12.3% (10)***	45.7% (37)	40.7% (33)
2013 participants (83)	9.6% (8)	9.6% (8)	68.7% (57)	65.1% (54)
2013 comparison (109)	11.0% (12)	10.1% (11)	57.8% (63)	51.4% (56)
All 2011 to 2013 participants (222)	5.9% (13)	5.9% (13)	65.3% (145)	62.2% (138)
All 2011 to 2013 comparison (271)	10.7% (29)**	9.6% (26)*	57.8% (156)**	52.0% (141)**

Significant differences between the participant and comparison groups *p<.10 **p<.05 ****p<.001.

We also examined two intermediate measures for assessing likelihood of graduation: the ratio of earned credit hours to attempted credit hours (see Table 8) and pre/post-program GPA (Table 9). Table 8 shows that although the STEP students did not always start with a higher ratio (e.g. 2011), they picked up the course completion pace and improved over the following semesters. However, the same cannot be said about the non-STEP students, who seem to regress, or to not improve as notably overall, throughout subsequent semesters. Note that ideally this ratio is a perfect 1.00, indicating complete success in taking credit hours.

Table 8. *Credit Ratio For Step Participants and the Comparison Group.*

Cohort	Pre-program credit ratio	Post-program credit ratio (up to 6 semesters)	Post-program credit ratio (up to 9 semesters)
2011 participants (69)	.884 (.122) N=68	.923 (.13) N=69	.925 (.12) N=69
2011 comparison (81)	.892 (.118) N=78	.878 (.22) N=81	.876 (.22) N=81*
2012 participants (70)	.911 (.12) N=66	.923 (.12) N=70	.919 (.125) N=70
2012 comparison (81)	.865 (.14) N=78	.843 (.23) N=81***	.851 (.23) N=81**
2013 participants (83)	.884 (.17) N=73	.933 (.11) N=83	.940 (.10) N=83
2013 comparison (109)	.854 (.18) N=93	.881 (.16) N=107**	.890 (.16) N=108***
All 2011 to 2013 participants (222)	.893 (.14) N=207	.927 (.12) N=222	.929 (.12) N=222
All 2011 to 2013 comparison (271)	.869 (.152) N=249*	.868 (.20)*** N=269	.874 (.20) N=270****

Significant differences between the participant and comparison groups: ****p<.001; ***p<.01; **p<.05; *p<.10.

Lastly, an indirect measure of retention and graduation rate/achievement is pre/post program GPA. GPA data are presented in Table 9 below. Students who participate in STEP have a higher average GPA than their cohort peers who do not participate. This is true both prior to program participation and after participation begins. This suggests that students who participate in STEP may be "stronger" students academically and conversely that those who are eligible, but choose not to

participate in STEP, do not perform as well in their courses relatively speaking. Furthermore, the rate of GPA increase is notably higher for STEP students compared to non-STEP students.

Table 9. *GPA for Step and Non-Step Students.*

Cohort	Pre-program GPA	Post program GPA (to sem 6)	Post program GPA (to sem 9)
2011 participants (69)	3.36 (.59) N=68	3.41 (.47) N=69	3.41 (.48) N=69
2011 comparison (81)	3.29 (.55) N=79	3.24 (.68) N=79*	3.26 (.66) N=79*
2012 participants (70)	3.33 (.74) N=67	3.34 (.53) N=70	3.36 (.54) N=70
2012 comparison (81)	3.17 (.53) N=78	3.11 (.62) N=79***	3.16 (.62) N=79**
2013 participants (83)	3.15 (1.07) N=76	3.44 (.50) N=83	3.46 (.50) N=83
2013 comparison (109)	3.08 (.85) N=95	3.16 (.66) N=108****	3.19 (.67) N=108***
All 2011 to 2013 participants (222)	3.28 (.84) N=211	3.40 (.50) N=222	3.41 (.51) N=222
All 2011 to 2013 comparison (271)	3.17 (.68) N=252	3.17 (.65) N=266****	3.20 (.65) N=266 ****

Significant differences between the participant and comparison groups: ****p<.001; ***p<.01; **p<.05; *p<.10.

While the descriptive presented above regarding GPA and the ratio of earned to attempted credits suggest that there are some differences between STEP participants and those in the cohort comparison group, it is unclear whether those differences are due to program participation or differences in the students themselves. That is, students who participate in STEP may be "stronger" students to begin with, and therefore participation in STEP may not increase graduation and retention. In response to this concern, the evaluator completed a series of multivariate regressions to assess whether participation in STEP had an effect on graduation and retention, independent of other variables that are likely to impact graduation and retention or their intermediate measures. In this section, we present the results of these analyses.

Table 10. *Multivariate Analysis of Factors Affecting the Gpa of Student Participants.*

Post-program GPA Regression results (to semester 9)	Unstandardized coefficients		Standardized coefficients
	B	SE	β
Participant****	.165	.050	.143
Age****	-.015	.005	-.147
Female	.049	.061	.035
Minority****	-.181	.050	-.158
First generation college student	-.057	.061	-.041
Amount of initial financial aid	.000003	.000	.016
Pre-program GPA****	.221	.033	.293
Constant	2.780	.180	---
R^2=.191, F (7,450) = 15.146, p <.001			

****p<.001.

To determine whether participation in STEP has an independent effect on GPA after the program begins, the evaluator completed a multivariate regression, controlling for variables that are thought to be predictive of post-program GPA. As would be expected, pre-program GPA was the strongest predictor of post-program GPA. Other statistically significant variables include age (older students had a lower GPA) and whether the student was a minority college student (students who were in the minority had a lower post-program GPA). The results also indicate that program participation is significantly related (p=.001) to post-program GPA (up to nine semesters) once other variables are accounted for. These results, displayed in Table 10 below, indicate that the program has some effect on post-program GPA. The first two columns show the unstandardized regression coefficients and standard errors, while the third column shows the standardized beta coefficients.

Next, the evaluator assessed the impact of the program on post-program credit attainment (up to nine semesters). The results of a multivariate regression of factors related to post-program completion of earned to attempted credits among students in the 2011, 2012, and 2013 cohorts are presented below in Table 11. Age and pre-program credit ratio were both significantly related to post-program credit attainment. Older students were significantly more likely to have lower credit attainment, while students with higher pre-program credit ratios were significantly more likely to have higher credit attainment. The participant variable, which differentiates between STEP and non-STEP students, was also statistically significant. The significant (p<.001), positive coefficient indicates that STEP students have a higher percentage of credit attainment, even once other variables such as pre-program credit ratio and age are accounted for. Furthermore, the relationship between the participant variable and post-program credit completion was the strongest among the variables in the model, suggesting that participation in STEP is associated with improved course completion. It is important to note, though, that approximately 9% of the variance in the dependent variable is accounted for in this model indicating that there are important predictor variables that are not included here. However, due to the strong relationship between program participation and the ratio of earned to attempted credits, we would expect that this finding would hold.

Table 11. *Multiple Regression Results for Post-Program Completion of Earned to Attempted Credits.*

Post-program earned to attempted credits Regression results to 9 semesters	Unstandardized coefficients		Standardized coefficients
	B	SE	β
Participant***	.048	.016	.143
Age**	-.004	.001	-.139
Female	-.010	.019	-.026
Minority	-.021	.016	-.064
First generation college student	.005	.019	.013
Amount of initial financial aid	-.000003	.000	-.044
Pre-program GPA	.028	.018	.095
Percent pre-program earned/attempted credits*	.121	.074	.101
Constant	.741	.072	
R^2=.092, F (8,442) = 5.594, p <.001			

***p<.01; **p<.05; *p<.10

Table 12. *Internship Experiences of Step Students.*

Agreed or strongly agreed that:	2011-12 (N=37 unless otherwise specified)	2012-13 (N=31 unless otherwise specified)	2013-14 (N=37)	2014-15 (N=45 unless otherwise specified)	2015-16 (N=18)
I had a positive experience	94%	100%	100%	98%	100%
I learned a lot from my internship	91%	97%	97%	96%	83.3%
The level of responsibility was compatible with my abilities	88%	97%	95%	98%	94.4%
I was assigned meaningful tasks in my internship	84%	97%	92%	96%	94.4%
I received adequate training to complete the tasks assigned during my internship	91%	90%	95%	89%	83.3%
The internship was relevant to my skills	81%	93%	97%	91% (N=44)	88.9%
The internship was relevant to my interests	91%	90% (N=30)	86%	89%	88.9%
I attained skills that I can use in my future career	88%	100%	100%	93%	94.4%
I attained knowledge that I can use in my future career	87% (N=31)	100%	100%	96%	94.4%
I am now more confident in my choice of a major	88%	100%	92%	93%	83.3%
As a result of this internship, I am more likely to pursue an advanced degree	63%	87%	89%	80%	55.6%
I am more certain I wish to pursue a career in this field after the internship	78%	87%	84%	87%	66.7%
I learned what is expected from professionals in my field	80%	97%	95%	96%	83.3%

Each year the STEP students who participate in a STEP-funded internship are asked to complete a survey about their experiences. In Table 12, we present the results from select survey questions; the data consists of responses from all five cohorts that have completed internships to date. The first several questions ask students to indicate the level of satisfaction they have with their internship. Students are generally very satisfied with their internships in many ways including the overall experience, how much they learned, whether it was meaningful, and the level of responsibility they were given, among other factors.

Importantly, the results indicate that students are more confident about their academic and career goals after completing an internship. This suggests that the opportunity to participate in the internship may have increased their self-efficacy in these areas. This is important as others have found that self-efficacy is an important component of retention and graduation (refer to Literature Review).

5. Conclusions

Overall, these results suggest that students who participate in the STEP program are likely to perform better than their peers who do not participate in STEP. One reason for this relationship could be that the students who participate in STEP may already be stronger students at the outset. For example, STEP students have higher GPAs than their cohort peers to begin with. Participants and non-participants are similar in terms of age, ethnicity, or whether they are a first-generation college student; however participants are actually more likely to be female, which has traditionally been considered a more at-risk group among Engineering majors. Furthermore, once key predictor variables are controlled for in the multivariate equations, participation in STEP is still a significant predictor of positive outcomes (higher post-program GPA and higher percentage of earned to attempted credits). Lastly, STEP students appear less likely to leave Engineering compared to their cohort peers; they are also more likely to graduate faster. Therefore, it is apparent to the authors from this study that the combination of faculty mentoring, student interactions, activities that boost students' engineering identity (conferences and internships in this case) have a positive influence on students' academics, and their retention and graduation. It is therefore recommended for other higher education institutions to consider similar student activities to address their issues with retention and graduation.

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