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Outcomes of an Academic Scholarship Program at the City University of New York – New York City College of Technology

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Abstract

We are on a threshold of a revolution in technology education where human knowledge is increasing at an extremely rapid rate. In the wake of these technological advancements, the required workforce skills and competencies are constantly changing. This combination of human knowledge and technological advancements is placing a demand on educators to prepare students with strong integrated technical skills in their selected educational discipline, as well as professional skills such as critical thinking and problem solving. The purpose of the Academic Scholarship Program at the New York City College of Technology – City University of New York was to develop a comprehensive experience to prepare students for such demands of the workforce. The program consisted of extra-curricular activities and educational programming to enhance the classroom experiences of the scholars. The academic, professional development and internship activities were tracked in order to determine and enumerate and the impact of the scholarship program. The impact of this program is reported through the attainment summary of the program's educational objectives, institutional academic support, professional development, student retention

rates, and a review of workplace initiatives of the Academic Scholars Program.

Keywords: NSF S-STEM Program, Engineering the Future, Assessment and Evaluation, financially disadvantaged students

Introduction

Engineering the Future: Pathways to Success for Women and Underrepresented Students in the Engineering Technologies is a National Science Foundation (NSF) Scholarship-STEM (S-STEM) funded project that began in Fall 2012 and was designed to support a scholarship program for thirty academically promising but financially disadvantaged students, with particular consideration given to female students in the City Tech. Associate and Bachelor degree programs in four departments at the College are listed in Table 1 below:

In order to carefully monitor the progress of the scholarship recipients and the impact of the program, the College included a detailed assessment plan that was implemented throughout the duration of the grant award. These assessment tasks included building a project database that maintained scholarship information (amount, duration, and recipients),

academic progress records, participation in cohort activities, academic support interventions for individual recipients, and workplace internships.

Program Objectives

The College's NSF S-STEM grant award, Engineering the Future, was administered with the objectives to serve the students participating in four eligible STEM programs at the college:

Project Objective 1: To identify and recruit NSF S-STEM scholarship applicants from a large diverse pool of academically talented entering, continuing, and transfer students at the associate and baccalaureate levels, with an emphasis on attracting eligible female candidates.

Project Objective 2: To select, enroll, and maintain a steady cohort of 30 full-time NSF S-STEM scholars on the basis of financial need and academic promise in Departments of Computer Engineering Technology, Computer Systems Technology, Electrical and Telecomm. Engineering Technology, and Mechanical Engineering Technology.

Project Objective 3: To increase numbers of female students, a severely underrepresented population in

Department	Program
Computer Engineering Technology (CET)	Electro-Mechanical Engineering Technology (EMT – AAS)
	Computer Engineering Technology (CEB - BTech)
Computer Systems Technology (CST)	Computer Information Systems (CIS – AAS)
	Computer Systems (CIB - BTech)
Electrical and Telecommunication Engineering Technology (ETET)	Electrical Engineering Technology (EET – AAS/BTech)
	Telecommunication Engineering Technology (TC – AAS/BTech)
Mechanical Engineering Technology (MET)	Industrial Design (ID – AAS/BTech)
	Mechanical Engineering Technology (MET-AAS/BTech)

Table 1: List of AAS and BTech degree programs in four departments at the College

engineering technology programs at City Tech, who are pursuing degrees in the targeted technology departments by 25% over four years.

Project Objective 4: To enable 80% of NSF S-STEM Scholars to persist in their studies to the following year.

Project Objective 5: To graduate more NSF S-STEM Scholars pursuing an Associate in Applied Science (A.A.S.) in the selected program degree in two years, an increase 20% over degree completion rates of other students in the School of Technology and Design.

Project Objective 6: To graduate more S-STEM Scholars pursuing a Bachelor's of Technology (B.Tech.) degree in four years, an increase of 20% over other students, to degree completion in School of Technology and Design.

Project Objective 7: To provide NSF S-STEM Scholars a comprehensive matrix of academic and personal support that includes peer mentoring, tutoring, counseling, outreach, advisement, research and internship opportunities, First-Year Learning Communities, and peer-led team learning (PLTL) for the NSF S-STEM recipients by PI and four co-PIs, Placement Office, Financial Aid Office, Student Services, and Enrollment Management staff.

Project Objective 8: To involve all NSF S-STEM Scholars in research seminars/conferences, field trips, and poster presentations in order to develop their research interests and convey the excitement of "doing" science and technology.

Project Objective 9: To monitor and evaluate through formative and summative evaluation activities in coordination with the Office of Assessment and Institutional Research (AIR) the effectiveness of the proposed activities in increasing enrollment, persistence, academic success, and graduation rates of NSF S-STEM scholarship recipients.

Research Design

Research Background

Student retention and persistence in engineering education have received much academic attention in recent years, with researchers examining the challenges that engineering students face in navigating the undergraduate academic system and the barriers in engineering education (Gill, Sharp, Mills, & Franzway, 2008; Sheppard, Gilmartin, Chen, Donaldson, Lichtenstein, Eris, Lande, & Toye, 2010). While large-scale instruments such as APPLES (Sheppard et al., 2010) and MIDFIELD (Zhang et al., 2004) were developed and have revealed a variety of institutional factors and academic preconditions that correlate to academic performance, they often overlook the diverse social realities present at individual educational institutions. It is no surprise that more and more scholarly activities target issues in previously under-explored areas in the field of engineering education including gender, diversity, and non-academic factors (Marra et al., 2011; Ohland et al., 2011). However, there is much to do to advance

the frontier of knowledge in engineering education. The changing demographics of college student populations are a national trend (Snyder & Dillow, 2012), and yet a review of engineering education literature reveal little about underrepresented student populations within a metropolitan setting. This research design is positioned to address this gap in academic knowledge and to answer the scholarly calls to utilize qualitative research approaches to explore new understandings of student issues pertinent to engineering education (Borrego et al., 2009).

Research Focus

Central to the research design of this study is our focus on developing a foundational understanding of NSF S-STEM scholars' college experiences as part of their engagement and participation in a S-STEM program that is distinguished by the vast offering of professional development activities, research opportunities, academic and personal advising services in a supportive educational ecosystem. The research focus of this project is tri-fold. First, we examined NSF S-STEM scholars' experiences in their navigation of academic pathways and how the NSF S-STEM program supports the scholars to meet challenges and reach goals. Second, we explored how S-STEM scholars interact with faculty and peers, and how these interactions result in formation of social groups that help them identify themselves within the field of engineering. Third, we examined how students view the impact of the NSF S-STEM on their professional development and their preparation for STEM careers. The research questions are:

- 1) What are NSF S-STEM scholars' experiences navigating the engineering technology program?
- 2) How do NSF S-STEM scholars engage and participate in the program?
- 3) How do NSF S-STEM scholars view the value of being part of the program?

Methods

Research Approach

This research study adopts a qualitative research approach as they offer a naturalistic approach (Patton, 2002) and they permit the explorations of lived experiences of research participations to address the research

questions at hand (Creswell, 2009). Data collection will be performed by means of carrying out semi-structured interview with selected participants and observations of professional development activities (Patton, 2002). Data analysis through open coding procedures (Strauss & Corbin, 1998) will be carried out to identify themes or categories that will bring out the major ideas to address the main research questions. Privacy and confidentiality of research participants are kept to the fullest extent with compliance to the institutional review board (IRB).

Program Database

Because this project was relatively small ($n = 94$), and to allow for more convenient access to the data, Microsoft Office Excel was selected to store the project data. In total, there were five datasets (displayed as tables) that were maintained by the Project Director.

1. Scholar basic info table: scholar name, gender, date of birth, degree program, S-STEM start date, race, email, address, etc.
2. Stipend info table: stipend recipient list, stipend amount, both by semester.
3. Scholar school info table: scholar names, academic plan (major), and GPA.
4. Program research activity table: program activity attendance records.
5. Survey info table: the result of three 12-question surveys conducted in Spring 2014, Fall 2014, Spring 2015, Fall 2015, and Spring 2016.

Results and Discussions

Scholar Summary

From Fall 2012 to Spring 2016, 94 students were awarded NSF S-STEM scholarships. As Figure 1 demonstrates, 22% of the scholars were female (21 out of 94) and Bachelor's degree seeking students represented 83% of the scholarship students at the time of initial award. It should be noted that sixteen of the 26 (62%) Associate degree seeking students transferred to a Bachelor's degree program within the same department while a recipient of a scholarship stipend (see Table 2).

The scholarship recipient ethnicity data are reported in Table 3. Thirty-six scholars (38%) were Black, Non-His-

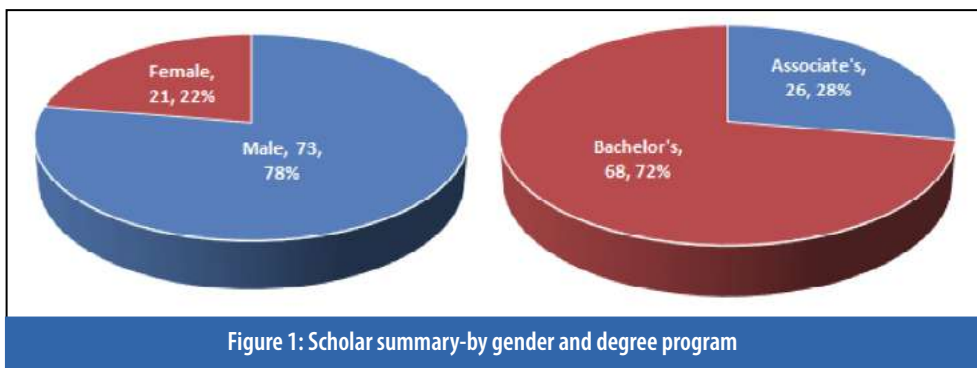


Figure 1: Scholar summary-by gender and degree program

Department	Associate Degree	Bachelor's Degree	Assoc (initial) to BTech transfer
Computer Engineering Tech	1	20	2
Computer Systems Tech	3	23	4
Electrical & Telecomm Engineering Tech	3	20	7
Mechanical Engineering Tech	3	5	3
Total	10	68	16

Table 2: Scholar summary- by degree

Ethnicity	S-STEM Scholars (N)	S-STEM Scholars (%)	STEM Departments (N)	STEM Departments (%)
American Indian or Native Alaskan	0	0.0%	23	0.5%
Asian or Pacific Islander	31	33.0%	1123	25.6%
Black, Non-Hispanic	36	38.3%	1172	26.7%
Hispanic	17	18.1%	1385	31.6%
White, Non-Hispanic	10	16.6%	441	10.1%
Nonresident Alien	0	0.0%	243	5.5%
Total	94	100.0%	4387	100.0%

Table 3: Ethnicity distribution of Scholars

panic; 31 scholars (33%) were Asian or Pacific Islander; 17 scholars (18%) were Hispanic; and 10 scholars (11%) were White, Non-Hispanic. Approximately 89% of the scholarship recipients were considered a U.S. ethnic minority. The ethnicity of all of the students enrolled in the four STEM department programs from the project database was also determined. Overall, City Tech's U.S. ethnic minority representation was 89% among the four eligible STEM programs.

According to the scholars' reported career goals, the highest ranked professions of interest were in Computer Engineering Technology (21 out of 94), Electrical Engineering Technology (12 out of 94) and Telecommunication Engineering Technology (12 out of 94). Figure 2 presents the career goals of the scholarship recipients, indicating 99% of the scholars intend to pursue a career within the STEM fields (n=93).

Female Student Representation

As noted in the previous section, the overall percentage of female scholars was 22.3% (21 out of 94). The representation of female students in the NSF S-STEM program is more than double the percentage of female students enrolled in the STEM departments at the college. Female enrollment in STEM departments at the college ranged from 8.9% for Fall 2012 to 10.0% for Spring 2016

(see Figure 3). Details are displayed in Figure 3 in Female Percentages.

It is important to note that only two of the 25 (8%) initial Associate degree seeking students were female, but



Figure 2: Career goals of scholars

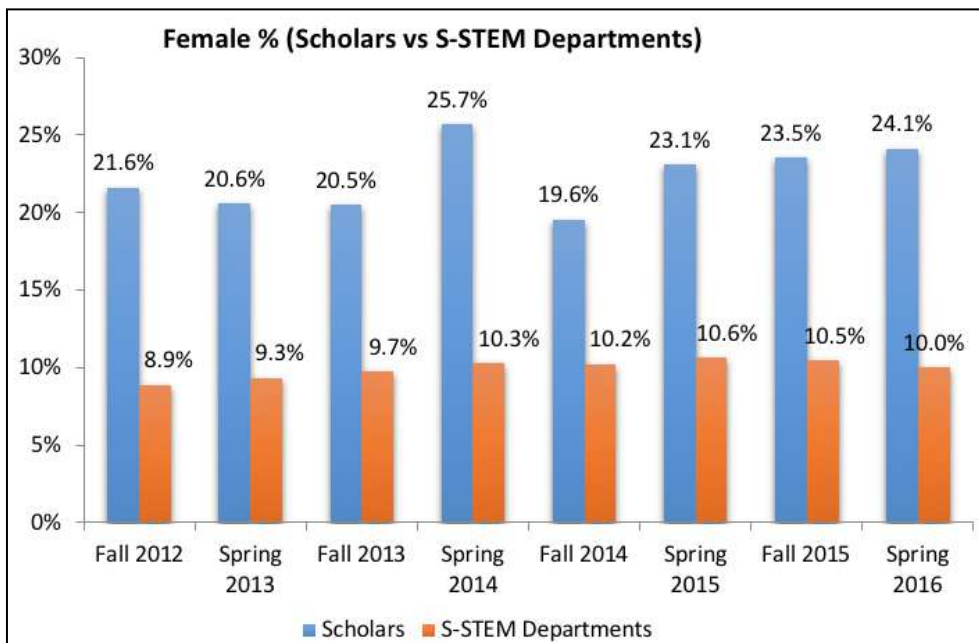


Figure 3: In Female percentages (NSF S-STEM Scholars vs STEM Departments)

Semester	Total Fund Used (\$)	Average Stipend per Scholar (\$)
Fall 2012	65,000	1,757
Fall 2013	79,000	2,026
Fall 2014	86,290	1,876
Fall 2015	88,000	2,588
Spring 2013	60,500	1,779
Spring 2014	66,940	1,913
Spring 2015	75,333	1,932
Spring 2016	22,800	786
Total	543,863	1,856

Table 4: Stipend summary

S-STEM Scholars	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Overall
Attended Recruitment Activity	37	30	37	26	45	38	33	27	273
Total	37	34	39	35	46	39	34	29	293
% of attendance	100%	88%	95%	74%	98%	97%	97%	93%	93%

Table 5: Scholar attendance in recruitment activity

Admission Type	# of Scholars	% of Scholars
Continuing Degree	85	90.4%
First-time Freshman	4	4.3%
Undergraduate Transfer from CUNY CC without Degree	3	3.2%
Undergraduate Transfer from SUNY CC without Degree	1	1.1%
Undergraduate Transfer from Unknown Sources	1	1.1%
Total	94	100.0%

Table 6: Scholar Admission Type

both of these students successfully transferred to a Bachelor's program within their respective Associate program department while they were receiving a scholarship stipend.

Stipend Summary

Between Fall 2012 and Spring 2016, \$543,863 in NSF S-STEM stipends were issued to the 94 scholars. A scholarship recipient was eligible to receive a maximum of a \$3,000 stipend per semester, according to their qualifications and financial need. According to the summary data illustrated in Table 4, the average total stipend amount per scholar received was \$5,786 and average semester stipend per scholar was \$1,856. The maximum stipend a student received through the program was \$15,800 over eight semesters and the smallest stipend distributed was \$600 due to financial need.

Scholar Recruitment

As illustrated in Table 5, the recruitment activities planned by the Project Director were successful in attracting potential scholars for the NSF S-STEM program. Overall, 93% of the scholars were successfully recruited via the program management team recruitment efforts.

As Table 6 indicates, the vast majority of the scholars (90.4%) were continuing degree students who were included in the enrolment statistics at that level the preceding reference year, 4.3% were first-time freshman and approximately 5.4% were transfer students.

Among the scholars, 22.3% were female students, while the female percentages were much smaller in the four STEM departments (details are displayed in Figure 3 in Female Percentages); and 88% of the scholars were ethnic minority students.

Scholar Retention

Since the program started in Fall 2012, the number of students served (duplicated count of scholarship recipients) each semester was 37, 34, 39, 35, 46, 39, 34, and 29 respectively, for each of the eight semesters through Spring 2016. This distribution represents 94 individual students.

Scholar Financial Need

All students in the NSF S-STEM Scholarship program had a financial need and qualified for the S-STEM scholarship per the NSF and City Tech guidelines; however, it was of interest to conduct additional analyses. As a proxy for low-income, we examined the Pell eligibility financial aid indicator of the scholars, as well as for the students enrolled in the four STEM departments during

Pell Eligibility Status	STEM Departments	STEM Departments %	Program Scholars	Program Scholars %
Yes	2,371	56.7%	71	75.5%
No	1,809	43.3%	23	24.5%
Total	4,180	100.0%	94	100.0%

Table 7: Pell-eligible status comparison (NSF S-STEM Scholars vs STEM departments)

Fall 2014. Specifically, 76% of the scholarship recipients were Pell-eligible and considered low income students, whereas only 57% of students in the four S-STEM departments were reported as Pell-eligible in Fall 2014 (see Table 7).

Persistence Rates

According to the scholarship program's qualification requirements, the selected scholars were required to meet a series of criteria to remain eligible for the program, such as financial need and maintain a minimum 3.0 grade point average. The criteria were strictly enforced. Since Fall of 2012, 17 scholars left the program due to an inability to maintain the academic standards; nine scholars took a leave of absence within their scholarship tenure; one student left due to a change of major to an ineligible STEM program; and one student became financially ineligible.

To evaluate this grant objective, one-year persistence rates of the NSF S-STEM scholars were computed for the Fall 2012, Spring 2013, Fall 2013, and Spring 2014 semester cohorts. The transcripts of the fifty-nine scholars from Fall 2012, Spring 2013, Fall 2013, and Spring 2014 S-STEM semester cohorts were reviewed in order to compute the one-year persistence rate. Twenty-seven (46%) scholars remained eligible for NSF S-STEM Scholarship,

14 (24%) scholars became ineligible for NSF S-STEM Scholarship but remained in an eligible STEM academic program, 10 (17%) scholars graduated from an eligible STEM academic program, two students graduated from non-STEM eligible academic programs, and six (10%) scholars left City Tech without completing their degree.

Persistence was defined as follows: 1) eligible for the NSF S-STEM scholarship and continuing in a S-STEM program; 2) ineligible for the NSF S-STEM scholarship, but continued in the approved STEM program; or 3) graduated from the STEM eligible academic program within the one-year period (see Table 8). Using this definition, the overall persistence rate for the scholarship program for these four cohorts of students, was approximately 86%, which exceeds the program objective to enable 80% of the NSF S-STEM scholars to persist in their studies to the following year. From Table 9, the one-year retention rate for Fall 2013 in all four programs for AAS students was 62.9%, and for BTech students 75.7%.

Graduation Rates

Given the duration of the study, it was not possible to compute the typically reported six-year graduation rate. However, it is noteworthy that 42 (45%) S-STEM scholarship recipients graduated from City Tech. Of these

graduates, 19 students earned an Associate degree, while 23 were awarded a Bachelor's degree (of these 23, 9 were awarded both, an Associate and Bachelor's degree). All of the scholars graduated from an eligible STEM program. These levels of attainment are significantly higher than the college's general population. The six-year graduation rate for all four programs for AAS students was 19.7%, and for BTech students 24.4%. Given the duration of the study, it was not possible to compute the typically reported six-year graduation rate.

Program Support and Professional Development

The project management team planned and organized diverse activities for the scholars. The activities were aimed to improve the students' academic performance, to increase their confidence, and build their future career network. The scholar attendance to the various extracurricular program activities per semester was categorized and maintained by the Project Director from Fall 2012 to Spring 2015 (see Table 10).

The results indicated highest participation levels by activity type was:

- Meetings/conferences
- Mentoring
- Field trips
- Academic support services
- Seminars

All NSF S-STEM scholars participated in at least one of the professional development activities offered by the program. It is important to note that the percentage of students participating in research opportunities and

Semester	Initial Cohort	N and %	Remained Eligible for NSF S-STEM Scholarship	Ineligible for NSF S-STEM Scholarship but remained in STEM eligible Academic Program	Graduated from STEM eligible Academic Program	Graduated from non STEM eligible Academic Program	Persisted at City Tech but transferred to non-STEM Program	Left City Tech without completing degree
Fall 2012	37	N	18	9	6	1	0	3
		%	48.65%	24.32%	16.22%	2.70%	0.00%	8.11%
Spring 2013	6	N	2	3	1	0	0	0
		%	33.33%	50.00%	16.67%	0.00%	0.00%	0.00%
Fall 2013	10	N	4	2	2	1	0	1
		%	40.00%	20.00%	20.00%	10.00%	0.00%	10.00%
Spring 2014	6	N	3	0	1	0	0	2
		%	50.00%	0.00%	0.00%	16.67%	0.00%	33.33%
TOTAL	59	N	27	14	10	2	0	6
		%	45.76%	23.73%	16.95%	3.39%	0.00%	10.17%
Overall one-year persistence		N	51					
		%	86.44%					

Table 8: NSF S-STEM Scholar persistence

Department	Initial Cohort (AAS/BTech)	N and %	Overall One-year Retention Rates	Retained in Initial Program within City Tech	Retained in Another Program within City Tech	Retained at Another CUNY College	Not Retained within CUNY
CET	157/122	N	101/88	70/73	31/15	6/10	50/24
		%	64.3%/72.1%	44.6%/59.8%	19.7%/12.3%	3.8%/8.2%	31.8%/19.7%
CST	171/59	N	116/47	96/42	20/5	4/4	50/8
		%	67.8%/79.7%	56.1%/71.2%	11.7%/8.5%	2.3%/6.8%	29.3%/13.6%
ETET	169/4	N	109/3	86/0	29/3	11/0	43/1
		%	64.5%/75.0%	50.9%/0.00%	17.2%/75.0%	6.51%/0.00%	25.4%/25.0%
MET	92/54	N	61/43	49/38	12/5	3/3	28/8
		%	66.3%/79.6%	53.3%/70.4%	13.0%/9.3%	3.26%/5.6%	30.4%/14.8%
TOTAL	615/239	N	387/181	301/153	92/28	59/17	171/41
		%	62.9%/75.7%	48.9%/64.0%	15.0%/11.7%	9.6%/7.11%	27.8%/17.2%

Table 9: One-year Retention rates of first-time, degree-seeking, full-time, degree-seeking freshmen in four departments at City Tech in Fall 2013

Professional Development Activities	Fall 2012	Spring 2013	Fall 2013	Spring 2014	Fall 2014	Spring 2015	Fall 2015	Spring 2016	Total
Meetings/Conferences	36	26	35	32	45	30	30	25	259
Field Trips	24	24	25	18	22	17	18	19	167
Mentoring	8	8	33	16	45	16	6	21	153
Seminars	17	8	25	29	20	21	25	19	164
Academic Support Services	37	30	3	8	7	24	12	3	124
Career Counseling/Job Placement	23	11	12	7	14	19	20	9	115
Research Opportunities	3	8	13	13	11	19	23	15	108
Internships	4	8	12	12	13	15	15	15	94
Community Building	5	7	9	12	8	15	13	5	74
Other	2	0	0	0	0	2	1	0	5
Total Amount	159	130	167	147	185	178	196	158	1320

Table 10: Program activity attendance summary

internships, while not among the top five activity types, was significantly higher than the City Tech population of students in general.

Formative and Summative Assessment

The Project Director continuously monitored the NSF S-STEM program participants and consulted with the Office of Assessment and Institutional Research (AIR), as necessary, regarding student-level data. Due to the introduction of a new computer database at the college during Spring 2013, data was more easily accessible at the department level and did not require the AIR office staff to provide the student data reviewed throughout the duration of the project. However, the data maintained by

the Project Director were validated using the College's official database. Additionally, the Project Director conducted student surveys to evaluate the effectiveness of the STEM programs. At the request of the Project Director, the AIR staff completed a comprehensive survey analysis and an evaluation of the project goals and attainment of the program's support toward the NSF S-STEM program goals.

Survey Results

A survey was developed by NSF S-STEM program Project Director during the Fall 2013 semester in order to identify the strengths and weaknesses of the scholarship program. The survey was administered to NSF S-STEM recipients during the Spring 2014, Fall 2014, Spring 2015,

Fall 2015, and Spring 2016 semesters. The questionnaire included 12 questions to assess 1) the NSF S-STEM program orientation, 2) internship, 3) mentorship, 4) perceived program fairness, and 5) program satisfaction. The questionnaire is presented in Appendix A.

Respectively, during the five semesters, 69%, 74%, 72%, 88%, and 62% of the scholars participated in these survey administrations, with an average response rate of 73%. More than 70% of the scholars had been in the scholarship program for two semesters or more. Therefore, we can assume that student responses were provided with full familiarity of the program.

According to the survey results, scholars indicated strong positive feedback for all five areas of the S-STEM

scholarship program. For example:

- ✓ "I would recommend this program to other students." (Question 9), nearly all attended scholars in all three surveys reported that they would recommend this program.
- ✓ "This NSF S-STEM program helped me to increase my overall confidence." (Question 10), similarly, except one scholar chose "no opinion", all others responded this NSF S-STEM program helped them to increase their overall confidence. (See Appendix B).

Feedback and Comments

The survey respondents were asked to voluntarily provide any comments regarding the program. Through the five survey administrations, students indicated they liked the program and mentioned the program provided them with the support they needed to achieve their educational goals. Three students specifically thanked the PI for his generous help. Comments are listed in Appendix B.

NSF S-STEM Participant Characteristics

As the first step to understanding the NSF S-STEM population, descriptive statistics were calculated for the 94 NSF S-STEM participants and, where possible, compared to data from City Tech students in the corresponding four departments of NSF S-STEM scholar eligibility. Over half of NSF S-STEM participants were of traditional undergraduate age (< 23 years old), although participants ranged from age 17 to age 60. The average age for first time NSF S-STEM participants was 26.90, which is slightly older than the average age of City Tech students (25.32 in Spring 2013).

Students may participate in NSF S-STEM program at any time during their undergraduate studies. The most common year to qualify for an NSF S-STEM scholarship stipend was as a sophomore level student. The NSF S-STEM program indicated that full-time enrollment was required, in addition to the financial aid and minimum GPA requirements.

Program Outcomes

This section presents the overall evaluation results of the NSF S-STEM program that began during Fall 2012. All project objectives, excluding Project Objectives 5, and 6, were evaluated by the Office of AIR staff. Project Objectives 5 and 6 could not be evaluated since these objectives require graduation data that is not yet available. It should be noted that the Office of AIR validated the Project Director's institutional data, which was used as the basis of the analyses for this evaluation. Additionally, the records from the survey administration and scholarship activity logs were used to evaluate objectives for which the college does not routinely maintain such student records (e.g., research experiences with faculty, field trips). Only anecdotal evidence was available to assess Project Objective 7 and according to the Project Director, a matrix of services, as intended for this objective, was available to all partici-

pating NSF S-STEM scholars.

The evaluation revealed significant progress was made through a successful administration of the NSF S-STEM program. The main findings are as follows:

- \$543,863 in stipends were issued.
- 93% of the NSF S-STEM scholars were successfully recruited via the program recruitment efforts.
- 94 students were served by the NSF S-STEM program and represents a steady cohort of more than 30 full-time STEM students per semester.
- 77% of the NSF S-STEM scholars were considered low income compared to 57% in STEM population.
- 22% (21 out of 94) of the NSF S-STEM scholars were female compared to 10.4% in STEM population.
- 86% of the S-STEM scholars persisted (or graduated) in an STEM program within one academic year of receiving their initial scholarship award.
- 100% of the NSF S-STEM scholars engaged in at least one professional development activity.
- Scholars indicated high levels of satisfaction with the program's academic and personal support.

Conclusions

At City Tech, we believe that the NSF S-STEM program has promoted the opportunity for City Tech scholar students to become highly motivated, academically competent and successful, leading to productive and professional careers in the current engineering technology work force. From Fall 2012 to Spring 2016, 94 students have been granted NSF-S scholarships, 21 students being female. Approximately 89% of the students were low income minority students.

Students who were successfully admitted to the scholarship program were directed to set career goals. The students indicated the professions primarily of interest were computer engineering, electrical and telecom engineering, and mechanical engineering. Retention and persistence rates were carefully monitored throughout the duration of the grant award and the success of the program is reflected in the S-STEM Scholar persistence rate of 86.4%. A program of support services were provided to the scholars in order to enable them to maintain academic eligibility requirements. These services included peer mentoring, tutoring, counseling, advisement, and internships.

In addition to these support services, scholars were provided with an opportunity to participate in faculty research projects, seminars/conferences, field trips, and poster presentations. In reviewing the research of the S-STEM scholars, it was interesting to note that 47 percent of the students participated in a research activity based on their interest and some career experience gained from internships. Typical research papers included topics such as cyber security, satellite imaging, Fourier analysis, software testing, reducing medical waste, biomedical tissue, engineering education, and meteorology. Their

papers reflected a high degree of professionalism, and understanding.

Our program-planned field trips to institutions/companies were highly successful and included such venues as NASA, Metropolitan Transportation Authority (MTA), Microsoft Technology Center, Brookhaven National Lab, NASA, and the International Business Machines Corp (IBM), and Infor.com. These experiences helped expose the scholars to the current needs of industry and encourage exploration to make our scholars' active participants in their learning experiences and helped to improve the scholar's motivation, confidence, academic performance, and perhaps provided the tools to secure a rewarding career in the private or public sector work force.

In conclusion, the NSF S-STEM program has had a significant impact by improving educational opportunities, improving program support persistence, and increasing female participation. Perhaps, the strongest impact is that the participants gained the motivation, confidence, knowledge and skills to meet the demanding challenges of the current workforce, and thus become productive citizens of the global community.

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Appendix A: NSF S-STEM Scholars Questionnaire



New York City College of Technology of CUNY
NSF S-STEM Scholars Survey

Spring 2016



Rate each of the following activities according to the amount of workshop time devoted to the specified activity. Use the following scale:

For each item, circle the number that corresponds to your response:

1 = strongly agree; 2 = agree; 3 = neutral (no opinion); 4 = disagree; 5 = strongly disagree.

	Agree				Disagree
1. The orientation helped me understand better in NSF S-STEM program.	1	2	3	4	5
2. Interacting with the orientation leaders increased my understanding and interest in program.	1	2	3	4	5
3. The speakers were useful in providing opportunities of internships.	1	2	3	4	5
4. The speakers increased my interest in my future professional career.	1	2	3	4	5
5. The field trips provided me helpful and interesting information.	1	2	3	4	5
6. Program leaders encouraged me to attend seminars and workshops.	1	2	3	4	5
7. I have been received useful mentorship from program leaders.	1	2	3	4	5
8. Application process to this program has been fair.	1	2	3	4	5
9. I would recommend this program to other students.	1	2	3	4	5
10. This S-STEM program helped me to increase my overall confidence.	1	2	3	4	5
11. Overall, the experiences through this program has been satisfied.	1	2	3	4	5
12. How many semesters have been in this program (if you are new student then count as 1st semester):					
___ 1st Semester	___ 2nd Semester	___ 3rd Semester			
___ 4th Semester	___ 5th Semester	___ 6th Semester or More			

Any additional comments or suggestions:

Appendix B: Comments of Surveys

Comments collected in four surveys:

- 1) I love this program!
- 2) Very helpful program.
- 3) Excellent program to help students achieve their goals.
- 4) Excellent speeches & presentations.
- 5) I am excited to be in the program and look forward to take full advantage of his opportunity.
- 6) I would recommend this program to other students.
- 7) I appreciate the field trip of this semester is scheduled for spring when the school is closed. Because it used to conflict with the class schedules.
- 8) I suggest that the field trip should hold during school breaks because it is sometimes inconvenient.
- 9) I think the orientation could be on Friday. It's cozier day to attend it.
- 10) It was a good experience, knowledgeable and I had better understanding of my interest in future professional career.
- 11) This NSF S-STEM program helped me to increase my overall confidence.
- 12) Keep up the good work. I really appreciate it.
- 13) Professor Jang is great at being very close to students and has increased my confidence as a student. Thank you!!!
- 14) Chairman Jang has been a fantastic help, and a warm heart. This is not to be forgotten. Thank you!
- 15) Thank you for this great opportunity, being a NSF-Stem scholar helped me get my internship last summer. Thank you, Professor Jang.
- 16) The program is very inspiring and encouraging. The leaders encourage challenging yourself, which I believe enhances your current skills.
- 17) It has always been pleasure to be in this program. I really thankful to Professor Jang for helping us to provide this scholarship.
- 18) Professor Jang is very moving and inspirational!!