The NSF S-STEM Program 2010-2014 at Purdue University Northwest (Experience)

Prof. Harvey Abramowitz EngScD, Purdue University Northwest, Hammond

BS Materials Science 1972 Columbia University MS Extractive Metallurgy/Mineral Processing 1975 Columbia University EngScD Extractive Metallurgy/Mineral Processing 1983 Columbia Unviversity

Mr. Roy L. Hamilton, Purdue University Northwest

Throughout his career Roy L. Hamilton has been an advocate for providing the leadership and resources that promote educational opportunity for those who have traditionally been excluded from the American educational mainstream. He states that his advocacy and sense of service are very much influenced by a statement his mother made to him during the Christmas break before he was to receive his bachelor's degree from Morehouse College, "Roy Lee, never forget about poor people." For Hamilton, poor people are persons who have voice, but cannot use it for their benefit. His over thirty-five years, as a professional in higher education, he has provided voice to the voiceless and potency to those with voice. It is Hamilton's belief that every person should have the opportunity to seek a college education or pursue a Ph. D. regardless of their educational and socioeconomic background.

He currently holds the position of Assistant Vice Chancellor for Educational Opportunity Programs and Director of the Purdue University Northwest Ronald E. McNair Post-Baccalaureate Achievement Program, a federal program designed to prepare first generation/low-income students and students from underrepresented disciplines for graduate study. In addition, he also provides administrative leadership to other Purdue Northwest Programs that provide educational access and success for underrepresented student populations for student beginning in sixth grade through graduate study. He recently developed and implemented programing that addresses the needs of pre-college students interested in the STEM disciples using the arts and sports.

He also teaches courses such as the African American Experience and the Effects of Hip Hop on American Culture in the University's Ethnic Studies Program. His research interests are in neighborhood displacement and Black Migration, especially in the Post-World War II period. He received the Bachelor of Arts degree in History from Morehouse College (Atlanta); the Master of Arts degree from the University of Wisconsin-Milwaukee in American History; and did further study toward the Ph. D. in American History at Indiana University (Bloomington.)

The NSF S-STEM Program 2010-2014
at Purdue University Northwest

Abstract

The NSF S-STEM Program at Purdue University Northwest (a unification of Purdue University Calumet and Purdue University North Central) provided educational opportunities for financially needy but academically talented STEM students. Services and activities were designed to: 1) improve the undergraduate educational experiences, 2) increase the number of students completing the first stage of baccalaureate study, and those receiving degrees, and 3) increase the likelihood that a Scholar will be employed or enrolled in a graduate program. Initially, 26 students were chosen, divided between those in the beginning stages of a STEM major (15) and those at the upper level (11). Additional Scholars were added as Scholars graduated or left, with 59 total participants. ME (34%) and CE (17%) were the two most popular majors. The percentage of the underrepresented population was 37% (15% African American, 19% Hispanic and 3% Asian /Pacific Islander). The ratio of males to females was 3:1. For male students, 37% were from underrepresented groups, and for females 35%. A desired target was the maintenance of an overall 3.0 GPA by 90% of the participants each semester. The average of 79% fell short, but when the cumulative GPA was at least 2.8, the 90% level was attained. By the end of the program, 82% of the lower level completed the first two years of a degree, and 28 BS degrees had been obtained. Since many students do not finish their program in 4 years, the actual number of degrees eventually awarded in a STEM field totaled 54, or 92% of all the participants. Post 2014 graduate activities of Scholars indicate that most sought employment after graduation. To see the effectiveness of the program, comparisons were made between students who participated in the program and those who did not. The major differences were: percentage of underrepresented minorities (e.g, 36% vs. 27% for Fall 2013); female participants on average (19.5% vs. 13.5 %); and an average beginning GPA for all semesters of 3.38, as opposed to 2.79.

Background (at time of grant application)

Increasingly, over the past few decades, university faculty and administrators have realized the need to establish programs and activities that are intentionally designed to positively impact retention. "The problem of retaining students in a program of study in engineering has long been a problem for engineering educators…Roughly fifty percent of the students who begin in engineering leave the field before receiving their engineering degree [1]." According to Anderson-Rowland [2], the enrollment of minority freshman in engineering had increased more than six fold during the 1980s and 1990s. However the attrition rate for freshman engineering minorities was still high. Moreover, after five years of study, the graduation rate for minority students (African American, Hispanic American, and Native American), is much lower than that of non-minorities. Peter Schmidt [3], writing in *The Chronicle of Higher Education*, noted that inadequate preparation for college and having to work long hours outside of class contribute to the shortage of African American and Hispanic students successfully completing STEM-field degrees. In his review of a 2006 study conducted by the U.S. Department of Education, Schmidt noted that where most Black and Hispanic students run into trouble is after their third year.

According to the study, only 64.2 % of African American and Hispanic students received their degree after six years of study, compared to 94.8 % of Asian-American and 86.7 % of white students. As on the national level, the same held true for retention and graduation rates for engineering and technology majors at Purdue University Calumet, now Purdue University Northwest (PNW)-Calumet Campus. According to a 2007 study by the Purdue University Calumet (PUC) Office of Planning and Institutional Research, the retention rate of first time, full time students, who began in Fall 2005 in the School of Engineering, Mathematics and Science was 44.8%. This is in line with a previous study by the Departments of Engineering which indicated that approximately 50% of freshman engineering students do not pass to the sophomore year of study. The results also showed that the retention rate for the School of Technology was 56.8%. Furthermore, the graduation rate for minorities needed to be increased. For example, out of 34 baccalaureate degrees issued in Engineering fields during the 2005-2006 academic year, there were only five minority students - two African American, two Hispanic American, and one Asian/Pacific Islander. These numbers were in contrast to the student population which was 17.2% African American, 14.2% Hispanic, 1.3% Asian/Pacific Islander, and 0.4% American Indian (Table I). Purdue University Northwest-Calumet Campus resides in Lake County, which in 2005 had a total population over 493,000, with 25.3% African American and 12.2% Hispanic (Table II). Refer particularly to the populations in East Chicago, Gary, and Hammond that had the greatest number of the underrepresented students the program was seeking to recruit in STEM majors.

TABLE I: PROFILE OF PUC UNDERGRADUATE STUDENTS FALL 2006

Total of 8,387	**#**	**%**
Full Time	5142	55.3
Part Time	3245	34.9
Male	3604	42.7
Female	4783	57.3
Caucasian	5429	65.5
African American	1440	17.2
Hispanic	1193	14.2
Asian/Pacific Islander	108	1.3
Native American or Alaskan	37	0.4
Students with Disabilities	150	1.8
Male Average Age	25	
Female Average Age	27	
First Generation	6123	73
Pell Grants Received	3356	70

To more systematically address the issue of retention and attrition, universities now view retention in a similar vein as recruitment. Ronald Roach [4] noted that universities across the country have poured hundreds of thousands of dollars into retention programs, such as the Gateway program at the University of Texas at Austin. The Gateway program provided tutoring, academic advising, and peer counseling to 180 incoming freshmen for two years. “Retention is a process of implementing programs and techniques designed to prevent students from dropping out of college. In the Department of Engineering Technology at ETSU (East Tennessee State University), an effort was made to combat the attrition rate among students. The department

TABLE II: ETHNIC DISTRIBUTION OF GENERAL POPULATION (2005)

Target Student Population Cities & County	**E. Chicago**	**Gary**	**Hammond**	**Lake County**
Total Persons	30946	98715	79217	493297
African American	11172 (36.1%)	82921 (84.0%)	11566 (14.6%)	123804 (25.3%)
Hispanic	15968 (51.6%)	4837 (4.9%)	16636 (21.0%	60182 (12.2%)
Caucasian	3775 (12.1%)	9970 (10.1%)	49437 (62.4%)	298938 (60.6%)
Other *	247 (0.8%)	1086 (1.1%)	1584 (2%)	9373 (1.9%)
* Includes Native American/Alaskan, Asian, 2 or more races, etc.				
Source: U.S. Census: *Educational Attainment - 2005 American Community Survey*				

advisor/mentor responsibilities included, but were not limited to the following: 1) monitoring the educational progress of students, especially beginning freshmen and transfer students; 2) creating and maintaining advisement records and academic plans for advisees; and 3) actively participating in student orientation, recruitment, and retention activities [5]." The S-STEM program described here provided similar benefits for those Purdue University Calumet students chosen as Scholars. In fact, the 2007 publication *Rising Above the Gathering Storm* [6] recommends: "Increase the number and proportion of US citizens who earn bachelor's degrees in the physical sciences, the life sciences, engineering, and mathematics by providing 25,000 new 4-year competitive undergraduate scholarships each year to US citizens attending US institution." Thus the S-STEM program, in general, can be viewed as a prototype for increasing the numbers of graduates in STEM fields.

Programmatically, the S-STEM Program was designed based upon the Federal TRIO Student Support Services delivery model. Thus, S-STEM provided services such as one-on-one tutoring, academic advising and coaching, career advising, individualized assessments, financial aid guidance, graduate school admission advising, and social and cultural activities. S-STEM participants became a part of a network of faculty and staff members that assisted in overcoming problems that create barriers to access and success.

Goal

The goal of The Scholarships in Science, Technology, Engineering, and Mathematics (S-STEM)

Program at Purdue University Northwest-Calumet Campus, formerly Purdue University Calumet, was to provide educational opportunities for financially needy but academically talented STEM students. Services and activities were designed to: 1) improve the undergraduate educational experiences, 2) increase the number of students completing the first stage of baccalaureate study, and those receiving degrees, and 3) increase the likelihood that a Scholar will be employed or enrolled in a graduate program.

Approach

The approach taken to have a successful program was based on two previous NSF CSEMS grants at the university [7]. The Departments of Engineering and the Ronald E. McNair Post-Baccalaureate Achievement Program were the primary collaborators for those awards, as was the case for the S-STEM program reported here. Each area worked in tandem to provide a holistic approach to student success and learning. The successes, problems and lessons learned from the CSEMS grants provided feedback and insight for making the S-STEM program an improvement over its predecessors.

Scholars

Selection Process

Each student applying to the S-STEM Program submitted all of the following as part of his/her application materials: college grade point average, three letters of recommendation from individuals who are best able to speak to his/her academic potential, and a personal statement of his/her educational and career goals (Fig. 1). The S-STEM Scholars selection committee assessed the above indicators by assigning them point values: college grade point average – 30 points; letters of recommendation – 35 points; and personal statement – 35 points. The selection committee consisted of the advisor for engineering students, a faculty member of the Department of Mathematics, Computer Science and Statistics, who also served as the Department's advisor, and the Assistant Director of Upward Bound. After evaluating each student's application materials, scores were totaled. Applicants were ranked by the totals. Those students receiving the highest scores were selected as S-STEM Scholars.

Number of Scholars

Initially, twenty-six students were chosen, divided between those in the beginning stages of a STEM major (twelve freshmen and 3 sophomore level students) and eleven upper classmen (eight juniors and three seniors). Additional Scholars were added as Scholars graduated or left. Special consideration was given to groups (women, racial and ethnic minorities and persons with disabilities) underrepresented in STEM fields. For the number of students chosen to be in the program at a given time, the maximum scholarship award was $5300 for the academic year. The exact amount awarded was determined by the Office of Financial Aid and could be less than the maximum.

Program Services

Scholars were paired with faculty mentors, who served as advocates for Scholars' academic and career success. Activities included tutorial and writing assistance, undergraduate research opportunities, visitations to research laboratories and graduate schools, attendance and/or

participation in research conferences, professional career counseling, and work experiences. A more detailed list of services and those responsible for the particular service is given in Table III.

FIG. 1: SCHOLARSHIP APPLICATION FORM

Purdue University Northwest (Calumet)
NSF S-STEM Scholarship Program
Scholarship Application Form

Name: _____ **Advisor**:_____

Major:_____ **Classification**: _____ **GPA**: _____

Indicator	**Points**
GPA – 4.00 (30 pts.); 3.75 (27 pts.); 3.50 (24); 3.25 (21 pts.); 3.00 (18 pts); 2.75 (15 pts.); 2.50 (12 pts.): 2.25 (9 pts.); 2.0 (6 pts.); less 2.00 (0 pts.)	
Personal Statement – Consider grammar, clarity of ideas and how well applicant wrote statement based upon the following instructions, as well as other information found in application: *On a separate paper describe the academic and professional goals you would like to achieve. Be as specific as possible about research projects of particular interest to you. Be sure to include the route that you have taken to date to reach these goals, including any adversities you have had to overcome. State how the awarding of a NSF S-STEM Scholarship would assist you in achieving your academic and professional goals. Your Personal Statement should not exceed three double-spaced pages.* (maximum of 35 points)	
Reference Letters – Consider appropriateness, level of work ethics, dedication, and academic ability as demonstrated in letter for reference (maximum of 35 points.)	
TOTAL POINTS	

Comments:

Assessment and Evaluation

Objectives

A number of specific objectives were stated in the initial proposal that were used as yardsticks to assess the success of the program. The first was academic success and retention as measured by the participants maintaining a grade point average of at least 3.0 on a 4.0 scale. The second was the attainment of a baccalaureate degree. Upper level Scholars were to receive their baccalaureate degree at a rate of 90% by the end of the project. The third was the completion of the first stage of undergraduate study. Those who were lower classmen were expected to complete the first stage (first two years) of undergraduate study at a rate of 90% by the end of the project.

TABLE III: DEPARTMENTS, PROGRAMS, AND INDIVIDUALS WHO PROVIDE SERVICE

Department	Services
S-STEM Scholars Program	Funding for conference participation and graduate school visitations, academic advising
Undergraduate Research Program	Research opportunities with Purdue Calumet faculty
Student Support Services Program	Individualized tutoring, personal counseling, pre-advising, graduate school visitations, financial aid counseling
Ronald E. McNair Post-Baccalaureate Achievement Program	Individualized tutoring, personal and career counseling, assistance with graduate school application process, graduate school visitations, summer research internships, graduate school seminars
Skills Assessment Center	Group tutoring, supplemental instruction
Center for Career and Leadership Development (Career Services)	Assistance with internships, resume development, interview skills, development of cover letters
Counseling Center	Career and personal counseling, wellness seminars
Coordinator of Services for Students With Disabilities	Accommodations for students with documented disabilities
Departmental Faculty Mentors	Advocates for the S-STEM Scholar in the major department for advising, problem resolution and report to the S-STEM staff any needs/concerns regarding the scholar or the scholar's progress
TRIO Learning Center	Access to networked computers, fax machine, copier, and video conference room
Department Student Mentors	Engineering students serve as mentors for freshman to help build study teams and thus increase retention

Program Results and Evaluation

The academic level of the Scholars is given in Table IV which shows that for the first two years of the program, the majority of the students were underclassmen, in their first and second years of the given major. In the third and fourth years, the percentage shifted and there was a majority of junior level students during the third year and a majority of seniors during the final year.

Many disciplines in engineering and engineering technologies were chosen as majors by the Scholars. In addition, one could also choose to major in Mathematics or Computer Science (Table V). Mechanical Engineering (34%) and Civil Engineering (17%) were the two most popular majors. Further details about the disciplines chosen as a function of the eight semesters of the program are provided in Table VI. For all semesters, the top major was Mechanical Engineering.

The demographics of the Scholars are given in Table VII. The demographics were determined by ethnicity, gender, and by both ethnicity and gender for each semester and for the overall

Scholar population. For the 59 participants, 15% were African Americans, 19% Hispanic and 3% Asian /Pacific Islander. This gives the percentage of the underrepresented population as 37%. These numbers will be later compared to the overall minority percentage of students in the same disciplines. The ratio of males to females was 3:1. For the male students, 37% were from underrepresented groups, and for females the percentage was 35%.

TABLE IV: ACADEMIC LEVEL OF S-STEM SCHOLARS

LEVEL	**Fall 2010**		**Spring 2011**		**Fall 2011**		**Spring 2012**	
	#	%	#	%	#	%	#	%
Freshman	12	46	12	44	2	10	2	11
Sophomore	3	12	6	22	12	60	11	58
Junior	8	31	5	19	2	10	4	21
Senior	3	12	4	15	4	20	2	11
TOTALS	**26**	**100**	**27**	**100**	**20**	**100**	**19**	**100**

LEVEL	**Fall 2012**		**Spring 2013**		**Fall 2013**		**Spring 2014**	
	#	%	#	%	#	%	#	%
Freshman	1	5	1	5	2	6	2	7
Sophomore	4	18	4	18	3	9	3	10
Junior	14	64	13	59	13	39	9	30
Senior	3	14	4	18	15	45	16	53
TOTALS	**22**	**100**	**22**	**100**	**33**	**100**	**30**	**100**

TABLE V: S-STEM SCHOLARS BY DISCIPLINE

(Totals from Fall 2010 - Spring 2014

Discipline	**#**	**%**
Freshman Engineering	1	2
Electrical Engineering	6	10
Computer Engineering	3	5
Mechanical Engineering	20	34
Civil Engineering	10	17
Mathematics	7	12
Computer Science	3	5
Construction Management & Engineering Technologies	1	2
Electrical and Computer Engineering Technologies	2	3
Mechanical Engineering Technology	4	7
Computer Information Technology	1	2
Computer Graphics Technology	1	2
TOTAL	**59**	**100**

TABLE VI: S-STEM SCHOLARS BY DISCIPLINE AND SEMESTER

(Totals from Fall 2010 - Spring 2014)

	FALL 2010		SPRING 2011		FALL 2011		SPRING 2012	
Discipline	**#**	**%**	#	%	#	%	#	%
Freshman Engineering	1	4	1	4	0	0	0	0
Electrical Engineering	3	12	3	11	4	20	4	21
Computer Engineering	3	12	3	11	3	15	3	16
Mechanical Engineering	7	27	6	22	7	35	6	32
Civil Engineering	3	12	4	15	0	0	1	5
Mathematics	4	15	5	19	3	15	3	16
Computer Science	1	4	1	4	0	0	0	0
Construction Management & Engineering Technologies	1	4	1	4	1	5	0	0
Electrical and Computer Engineering Technologies	1	4	1	4	1	5	1	5
Mechanical Engineering Technology	1	4	1	4	0	0	0	0
Computer Information Technology	1	4	1	4	0	0	0	0
Computer Graphics Technology	0	0	0	0	1	5	1	5
TOTALS	**26**	100	**27**	100	**20**	100	**19**	100

	FALL 2012		SPRING 2013		FALL 2013		SPRING 2014	
Discipline	**#**	**%**	#	%	#	%	#	%
Freshman Engineering	1	5	1	5	2	6	2	7
Electrical Engineering	3	14	3	14	4	12	4	13
Computer Engineering	2	9	2	9	1	3	1	3
Mechanical Engineering	9	41	9	41	15	45	14	47
Civil Engineering	2	9	2	9	3	9	2	7
Mathematics	1	5	1	5	2	6	1	3
Computer Science	1	5	1	5	2	6	2	7
Construction Management & Engineering Technologies	0	0	0	0	0	0	0	0
Electrical and Computer Engineering Technologies	1	5	1	5	2	6	2	7
Mechanical Engineering Technology	1	5	1	5	2	6	2	7
Computer Information Technology	0	0	0	0	0	0	0	0
Computer Graphics Technology	1	5	1	5	0	0	0	0
TOTALS	**22**	100	**22**	100	**33**	100	**30**	100

	ALL SEMESTERS 2010-2014	
Discipline	**#**	**%**
Freshman Engineering	8	4
Electrical Engineering	28	14
Computer Engineering	18	9
Mechanical Engineering	73	37
Civil Engineering	17	9
Mathematics	20	10
Computer Science	8	4
Construction Management & Engineering Technologies	3	2
Electrical and Computer Engineering Technologies	10	5
Mechanical Engineering Technology	8	4
Computer Information Technology	2	1
Computer Graphics Technology	4	2
TOTALS	**199**	100

One of the milestones checked was the maintenance of an overall 3.0 GPA by the participants. Maintaining at least a 3.0 GPA for all semesters ranged from 68 to 88%, with an average of 79%. The average fell short of the desired target of 90%. When the overall cumulative GPA was at least a 2.8, then the 90% level was reached (Table VIII).

The Scholars had obtained 28 BS degrees by the end of the program (Table IX). Two students switched majors but were still in the realm of a STEM discipline. Once they switched, they no longer were supported. However, since the majors were within the STEM fields, the number of BS degrees could be considered 30. Since many students do not finish a STEM course of study in four years, the number of baccalaureate degrees obtained was much higher than 28 or 30. After 2014, 19 more BS degrees were completed. Thus the number of BS degrees in STEM disciplines is actually 49. If those Scholars who transferred to other Purdue campuses and finished an undergraduate degree are also included, then the number is 54. Given a Scholar population of 59, the completion rate was 92%, which was above the target percentage for the upper level students. By the termination of the program, the upper level students (31) had obtained a baccalaureate degree at the rate of 68%. Including those degrees received after the close of the program, the upper level student completion rate was 81%. This means that a number of lower level Scholars also obtained their BS degree within the time frame of the project. Details about the Degrees awarded by major are provided in Table X.

In terms of the lower level Scholars completing the first two years of an undergraduate degree, 23 /28 or 82% did so. Again this fell short of the 90% mark, but the lower levels are the most likely to change major or have trouble with some of the gateway courses.

The post 2014 graduate activities of Scholars (Table XI) indicate that most sought employment after graduation. A number went to graduate school. Four masters degrees have been attained to date.

TABLE VII: S-STEM SCHOLARS DEMOGRAPHICS

All Students 2010-2011		
Ethnicity	**#**	**%**
Caucasian	15	52
African American	7	24
Hispanic	2	7
Asian/Pacific Islander	2	7
Other	3	10
TOTAL	29	100

All Students 2011-2012		
Ethnicity	**#**	**%**
Caucasian	12	57
African American	3	14
Hispanic	2	10
Asian/Pacific Islander	1	5
Other	3	14
TOTAL	21	100

Gender	**#**	**%**
Male	21	72
Female	8	28
TOTAL	29	100

Gender	**#**	**%**
Male	17	81
Female	4	19
TOTAL	21	100

Ethnicity & Gender	**#**	**%** Total	% Gender
Male	*21*	*72*	*100*
Caucasian	13	45	62
African American	4	14	19
Hispanic	1	3	5
Asian/Pacific Islander	1	3	5
Other	2	7	10
Female	*8*	*28*	*100*
Caucasian	2	7	25
African American	3	10	38
Hispanic	1	3	13
Asian/Pacific Islander	1	3	13
Other	1	3	13

Ethnicity & Gender	**#**	**%** Total	% Gender
Male	*17*	*81*	*100*
Caucasian	10	48	59
African American	1	5	6
Hispanic	2	10	12
Asian/Pacific Islander	1	5	6
Other	3	14	18
Female	*4*	*19*	*100*
Caucasian	2	10	50
African American	2	10	50
Hispanic	0	0	0
Asian/Pacific Islander	0	0	0
Other	0	0	0

TABLE VII: S-STEM SCHOLARS DEMOGRAPHICS

All Students 2012-2013		
Ethnicity	**#**	**%**
Caucasian	13	59
African American	2	9
Hispanic	7	32
Asian/Pacific Islander	0	0
Other	0	0
TOTAL	22	100

All Students 2013-2014		
Ethnicity	**#**	**%**
Caucasian	21	64
African American	2	6
Hispanic	10	30
Asian/Pacific Islander	0	0
Other	0	0
TOTAL	33	100

Gender	**#**	**%**
Male	20	91
Female	2	10
TOTAL	22	100

Gender	**#**	**%**
Male	26	79
Female	7	21
TOTAL	33	100

Ethnicity &	**#**	**%**	%
Gender		Total	Gender
Male	*20*	*91*	*100*
Caucasian	12	55	60
African American	1	5	5
Hispanic	7	32	35
Asian/Pacific Islander	0	0	0
Other	0	0	0
Female	*2*	*10*	*100*
Caucasian	1	5	50
African American	1	5	50
Hispanic	0	0	0
Asian/Pacific Islander	0	0	0
Other	0	0	0

Ethnicity &	**#**	**%**	%
Gender		Total	Gender
Male	*26*	*52*	*100*
Caucasian	15	45	58
African American	1	3	4
Hispanic	10	30	38
Asian/Pacific Islander	0	0	0
Other	0	0	0
Female	*7*	*21*	*100*
Caucasian	6	18	86
African American	1	3	14
Hispanic	0	0	0
Asian/Pacific Islander	0	0	0
Other	0	0	0

All Students 2010-2014		
Ethnicity	**#**	**%**
Caucasian	33	56
African American	9	15
Hispanic	11	19
Asian/Pacific Islander	2	3
Other	4	7
TOTAL	59	100

Gender	**#**	**%**
Male	45	76
Female	14	24
TOTAL	59	100

Ethnicity &	**#**	**%**	%
Gender		Total	Gender
Male	*45*	*76*	*100*
Caucasian	25	42	56
African American	6	10	13
Hispanic	10	17	22
Asian/Pacific Islander	1	2	2
Other	3	5	7
Female	*14*	*24*	*100*
Caucasian	8	14	57
African American	3	5	21
Hispanic	1	2	7
Asian/Pacific Islander	1	2	7
Other	1	2	7

TABLE VIII: S-STEM SCHOLARS PROGRESS

	F2010	**S2011**	**F2011**	**S2012**	**F2012**	**S2013**	**F2013**	**S2014**	**Ave**
# of Scholars	26	27	20	19	22	22	33	30	25
% Semester GPA>2.80	85	81	75	63	68	86	88	80	78
% Semester GPA>3.00	69	78	70	53	68	86	85	77	73
% Cumulative GPA>2.80	92	93	95	84	86	86	91	90	90
% Cumulative GPA>3.00	88	81	85	68	73	77	79	80	79

TABLE IX: S-STEM PROGRAM DEGREES OBTAINED

	Year	**2010-11**	**2011-12**	**2012-13**	**2013-14**	**2014+**
Degree						
AS (#)					1	
BS (#)		3	4	4	19	19
MS (#)					1	3
Total BS(#)		***3***	***7***	***11***	***30***	***49***

Notes: a) 2013-2014 total includes transfers to other STEM disciplines not included in program - Biology (1) & Computer Information Systems in the College of Business (1)

b) If transfers to Purdue W. Lafayette & IUPUI are included, then the total to date is 54, not 49

Further details are given in Table X

TABLE X: DEGREES AWARDED BY MAJOR

	2010	2011	2012	2013		2014	2015	2016	2017
	2011	2012	2013	2014		2015	2016	2017	2018
Major	**BS #**	**BS #**	**BS #**	**BS #**		**BS #**	**BS #**	**BS#**	**BS#**
Electrical Engineering	0	2	0	2		1	0	0	1
Computer Engineering	0	0	0	1		1	1	1	0
Mechanical Engineering	1	1	1	4		6	4	0	0
Civil Engineering	2	0	1	4		0	0	0	0
Mathematics	0	0	2	2		0	1	0	0
Computer Science	0	0	0	1		1	0	0	0
Construction Management & Engineering Technologies	0	1	0	0		0	0	0	0
Electrical and Computer Engineering Technologies	0	0	0	1		0	1	0	0
Mechanical Engineering Technology	0	0	0	2		0	0	0	0
Computer Information Technology	0	0	0	0		0	0	0	0
Computer Graphics Technology	0	0	0	0		0	0	1	0
TOTAL	***3***	***4***	***4***	***17***		***9***	***7***	***2***	0
TOTAL All Semesters				***28***		***37***	***44***	***46***	***47***
Computer Information Systems-Management				1					
Biology				1					

NOTES:

a) 4 Students transferred to Purdue West Lafayette and earned the following BS degrees by major and year Civil Engineering (2011&2014); Mechanical Engineering (2014); Mathematics (2015)

b) 1 student transferred to IUPUI and received a BS degree in Mathematics (2015)

c) all 5 transferred students started their STEM studies at Purdue University Calumet bringing the total BS degrees by the end of the program in 2014 to 31

d) 2 students changed to other STEM majors not funded by the program, f the BS degrees earned in Biology (2014) and Computer Information Systems (2014) are included, the number of BS degrees in STEM majors by the end of the program is 33.

e) Since many students do not finish their degree in 4 years, when including those finishing at a later time, the number of students receiving a BS degree in a STEM major is 54 (92% of all participants).

TABLE XI: POST GRADUATE ACTIVITY OF S-STEM SCHOLARS
S2014

Post Graduate Activity	**#**	**%**
Graduate School	7	25
Seeking Employment	5	18
Employment	15	54
Graduate School & Employment	1	4
Other		
TOTAL	**28**	**100**

To see the effectiveness of the program, comparisons were made between students who participated in the program and those who did not. While the technology disciplines had higher number of students, apparently not as many either applied to the program, or were working and did not meet the financial qualification (Table XII).

TABLE XII: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY MAJOR

Major	2010-11		2011-12		2012-13		2013-14	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Non Participants	**825**	**857**	**970**	**935**	**957**	**886**	**921**	**895**
Civil Engineering	40	44	55	49	59	56	54	47
Computer Engineering	21	9	12	13	18	14	23	29
Computer Graphics Tech	160	149	147	138	155	141	134	135
Computer Science	41	39	49	45	48	49	48	52
Construct Mgmt & Engr Tech	82	93	155	150	119	125	121	112
Electrical Engineering	83	97	94	99	101	85	92	79
Electrical Engr Technology	131	140	131	135	147	127	133	126
Mathematics	76	81	72	65	63	54	47	55
Mechanical Engineering	82	77	90	84	84	75	105	103
Mechanical Engr Technology	109	128	165	157	163	160	164	157
Participants	**26**	**27**	**20**	**19**	**22**	**22**	**33**	**30**
Freshman Engineering	1	1	0	0	1	1	2	2
Civil Engineering	3	4	0	1	2	2	3	2
Computer Engineering	3	3	3	3	2	2	1	1
Computer Graphics Tech	0	0	1	1	1	1	0	0
Computer Information Technology	1	1	0	0	0	0	0	0
Computer Science	1	1	0	0	1	1	2	2
Construct Mgmt & Engr Tech	1	1	1	0	0	0	0	0
Electrical Engineering	3	3	4	4	3	3	4	4
Electrical Engr Technology	1	1	1	1	1	1	2	2
Mathematics	4	5	3	3	1	1	2	1
Mechanical Engineering	7	6	7	6	9	9	15	14
Mechanical Engr Technology	1	1	0	0	1	1	2	2
Total Headcount	**851**	**884**	**990**	**954**	**979**	**808**	**954**	**925**

The Scholars were full time students, as compared to those non-participating, which hovers around 70% (Table XIII).

The underrepresented population percentage is higher for the Scholars than for the non-participants. For example during the Fall 2013 semester, the percentage for Scholars was 36% (6% African American and 30% Hispanic) while for the non-participants, the percentage was

24.7% (8.4% African American and 16.3% Hispanic), or 27.3% when including Asian Americans (Table XIV).

TABLE XIII: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY COURSE LOAD

Course Load								
	2010-11		**2011-12**		**2012-13**		**2013-14**	
	Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Non Participants								
Full Time	68.4%	69.0%	71.6%	70.4%	73.0%	71.9%	72.6%	72.5%
Part Time	31.6%	31.0%	28.4%	29.6%	27.0%	28.1%	27.4%	27.5%
Participants								
Full Time	100.0%	100.0%	90.6%	88.9%	97.2%	94.6%	94.1%	96.7%
Part Time*	0.0%	0.0%	9.4%	11.1%	2.8%	5.4%	5.9%	3.3%

* Student did not complete a full load of courses during semester

TABLE XIV: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY RACE/ETHNICITY

Race/Ethnicity								
	2010-11		**2011-12**		**2012-13**		**2013-14**	
	Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Non Participants								
African American	8.5%	8.6%	9.1%	9.5%	7.5%	7.4%	8.4%	8.4%
American Indian	0.2%	0.2%	0.2%	0.1%	0.2%	0.0%	0.1%	0.1%
Asian American	2.1%	2.0%	2.4%	2.0%	2.2%	2.6%	1.7%	1.5%
Hawaiian	0.0%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.1%
Hispanic	17.0%	16.2%	14.8%	15.3%	16.3%	16.3%	16.3%	16.5%
Multi-race	1.3%	1.3%	1.0%	0.6%	0.6%	0.5%	0.9%	0.9%
White	62.1%	57.9%	58.2%	55.4%	55.5%	56.3%	55.6%	56.3%
Unknown	2.1%	2.1%	0.7%	2.4%	2.8%	2.1%	2.1%	1.9%
International	6.8%	11.7%	13.5%	14.4%	14.7%	14.7%	15.0%	14.3%
Participants								
African American	24.0%	24.0%	14.0%	14.0%	9.0%	9.0%	6.0%	6.0%
Asian American	7.0%	7.0%	5.0%	5.0%	0.0%	0.0%	0.0%	0.0%
Hispanic	7.0%	7.0%	10.0%	10.0%	32.0%	32.0%	30.0%	30.0%
Multi-race	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
White	52.0%	52.0%	57.0%	57.0%	69.4%	59.0%	64.0%	64.0%
Unknown	10.0%	10.0%	14.0%	14.0%	6.0%	6.0%	0.0%	0.0%

In general, the ratio of females to males is higher with those in the S-STEM program. The percentage of female participants was, on average, 19.5%, as opposed to the non- participation percentage of 13.5% (Table XV).

TABLE XV: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY GENDER

Gender								
	2010-11		2011-12		2012-13		2013-14	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Non Participants								
Female	14.9%	14.6%	13.1%	13.4%	13.0%	13.2%	13.0%	12.8%
Male	85.1%	85.4%	86.9%	86.6%	87.0%	86.8%	87.0%	87.2%
Participants								
Female	28.0%	28.0%	19.0%	19.0%	10.0%	10.0%	21.0%	21.0%
Male	72.0%	72.0%	81.0%	81.0%	90.0%	90.0%	79.0%	79.0%

There were slightly higher percentages of Indiana residents in the program than those not residing in Indiana (Table XVI).

TABLE XVI: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY RESIDENCY

Residency								
	2010-11		2011-12		2012-13		2013-14	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Non Participants								
Indiana Resident	78.8%	74.9%	70.9%	70.3%	70.2%	69.5%	69.2%	70.5%
Not Indiana Resident	21.2%	25.1%	29.1%	29.7%	29.8%	30.5%	30.8%	29.5%
Participants								
Indiana Resident	80.0%	81.0%	71.9%	72.2%	72.2%	73.0%	70.6%	70.0%
Not Indiana Resident	20.0%	19.0%	28.1%	27.8%	27.8%	27.0%	29.4%	30.0%

The Scholars were also a year or more younger than their counterparts (Table XVII).

TABLE XVII: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY AVERAGE AGE AT BEGINNING OF SEMESTER

	2010-11		2011-12		2012-13		2013-14	
	Fall	Spring	Fall	Spring	Fall	Spring	Fall	Spring
Non Participants	25	25	25	25	25	25	24	24
Participants	21	21	21	22	22	23	23	23

An important comparison is between the cumulative GPA of those who were in the program and those who were not. For those in the program, the average beginning GPA for all eight semesters was 3.38, as opposed to 2.79 for those who were not in the program. This is a substantial difference (Table XVIII).

TABLE XVIII: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY AVERAGE GPA AT BEGINNING OF SEMESTER
AVERAGE GPA AT BEGINNING OF SEMESTER

	2010-11		2011-12		2012-13		2013-14	
	Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Non Participants	2.84	2.78	2.72	2.78	2.79	2.85	2.73	2.85
Participants	3.24	3.52	3.60	3.37	3.29	3.30	3.32	3.41

Finally, the majority of Scholars were first generation college students, 63.5%, as opposed to 62.4% for their non-program peers (Table XIX).

TABLE XIX: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY LEGACY

Legacy Status								
	2010-11		2011-12		2012-13		2013-14	
	Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Non Participants								
First Generation	65.9%	66.1%	62.6%	61.5%	61.5%	61.4%	60.6%	59.6%
Not First Generation	34.1%	33.9%	37.4%	38.5%	38.5%	38.6%	39.4%	40.4%
Participants								
First Generation	55.6%	55.6%	60.0%	60.6%	66.7%	70.6%	70.0%	69.2%
Not First Generation	44.4%	44.4%	40.0%	39.4%	33.3%	29.4%	30.0%	30.8%

A comparison of gender and race/ethnicity between the two groups (Table XX) did not lead to any definitive conclusions.

Uniqueness of Program

The uniqueness of this program rests with the fact that at the Calumet Campus, this marked the first time that an area within Student Affairs and an Academic Affairs worked collaboratively to affect educational access and success. As a result of this collaboration, students benefited from the expertise of faculty members in terms of instruction, research and career development while also benefitting from the instrusive services provided by a Federal TRIO Program.

In a 2009 report by The Pell Institute, titled, *National Studies Find TRIO Programs Effective at Increasing College Enrollment and Graduation* [8], reported that students enrolled in the TRIO Student Support Services Program, were more than likely to 1) Remain enrolled in higher education; 2) Accrue more college credits; and 3) Earn higher grade point averages than students not receiving services from the Program. The report attributed SSS's outcomes to the services provided to participations, especially the tutoring. In order to be eligible for SSS services, a student must be first generation college and/or low-income.

TABLE XX: S-STEM PARTICIPANTS AND NON-PARTICIPANTS IN THE SAME BACCALAUREATE PROGRAM BY GENDER AND RACE/ETHNICITY GENDER AND RACE/ETHNICITY

	2010-11		2011-12		2012-13		2013-14	
	Fall	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**	**Fall**	**Spring**
Non Participants								
Female								
African American	17.9%	16.8%	13.4%	16.8%	14.5%	14.5%	15.8%	16.5%
American Indian	0.8%	0.8%	0.8%	0.0%	0.8%	0.0%	0.0%	0.0%
Asian American	0.8%	0.8%	1.6%	1.6%	1.6%	1.7%	0.8%	0.9%
Hawaiian								
Hispanic	15.4%	17.6%	14.2%	13.6%	17.7%	16.2%	19.2%	20.0%
Multi-race	2.4%	3.2%	3.1%	1.6%	0.8%	0.0%	0.0%	0.9%
White	56.1%	53.6%	57.5%	54.4%	54.0%	57.3%	54.2%	53.9%
Unknown	1.6%	0.8%	0.8%	4.0%	4.0%	3.4%	3.3%	2.6%
International	4.9%	6.4%	8.7%	8.0%	6.5%	6.8%	6.7%	5.2%
Male								
African American	6.8%	7.2%	8.4%	8.4%	6.5%	6.4%	7.2%	7.2%
American Indian	0.1%	0.1%	0.1%	0.1%	0.1%	0.0%	0.1%	0.1%
Asian American	2.3%	2.2%	2.5%	2.1%	2.3%	2.7%	1.9%	1.5%
Hawaiian	0.0%	0.0%	0.0%	0.2%	0.1%	0.1%	0.0%	0.1%
Hispanic	17.2%	16.0%	14.9%	15.6%	16.1%	16.3%	15.9%	16.0%
Multi-race	1.1%	1.0%	0.7%	0.5%	0.6%	0.5%	1.0%	0.9%
White	63.1%	58.6%	58.4%	55.6%	55.7%	56.2%	55.8%	56.7%
Unknown	2.1%	2.3%	0.7%	2.1%	2.6%	2.0%	1.9%	1.8%
International	7.1%	12.6%	14.2%	15.4%	16.0%	15.9%	16.2%	15.6%
Participants								
Female								
African American	38.0%	38.0%	50.0%	50.0%	50.0%	50.0%	14.0%	14.0%
Asian American	13.0%	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Hispanic	13.0%	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Multi-race	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
White	25.0%	25.0%	50.0%	50.0%	50.0%	50.0%	86.0%	86.0%
Other	13.0%	13.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
Male								
African American	19.0%	19.0%	6.0%	6.0%	5.0%	5.0%	4.0%	4.0%
Asian American	5.0%	5.0%	6.0%	3.8%	0.0%	0.0%	0.0%	0.0%
Hispanic	5.0%	5.0%	12.0%	19.2%	35.0%	35.0%	38.0%	38.0%
Multi-race	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
White	62.0%	62.0%	59.0%	65.4%	60.0%	60.0%	58.0%	58.0%
Other/Unknown	10.0%	10.0%	18.0%	0.0%	0.0%	0.0%	0.0%	0.0%

Lessons Learned

The majority of students who attended Purdue Northwest were first generation college students, 70% (including 63.5% of S-STEM Scholars). Overall, the University's first-generation college student rate was more twenty percent (20%) higher than the national average of 50%. In addition to eliminating barriers such as finances, we discovered the need to provide services and programming that addressed non-cognitive issues that may affect the successful completion of the college degree and applying for employment and graduate study. Because these students had no one in their families who previously attended college, they did not fully understand the customs and resources of the university. The students were well academically prepared but needed assistance in maneuvering the policies and procedures of our campus, assistance with obtaining internships, appealing grades, and advocating for themselves.

Other Issues

It would have been beneficial to the program had there been more financial (budgetary) support for the PIs and support staff. Without enough budgetary support, no FTE was given to the PIs to oversee and manage the program. Hiring of graduate students to help with the data collection and inputting the data into both the program and NSF databases would have been better if the same graduate student had been available for more than a year. Continuity of managing the grant became interrupted due to personnel changes. The original budget, as stipulated by NSF, had an 85/15 split, with 85% of the budget devoted solely for scholarships. This issue has been remedied by NSF and the split for S-STEM grants is now 60/40.

Students generally take more than 4 years to graduate. That meant that the total number of students attaining a BS degree by the end of the program was less than the actual number of students graduating in a STEM major. Having a 5 year grant period would be most beneficial in seeing that those in the program graduated by the end of the grant period. The new NSF S-STEM grants have five year durations and this issue has also been addressed.

The duration of this grant occurred during the recession. Many students, while given substantial tuition aid, needed to work outside the university to support themselves and help their families. Therefore, many Scholars could not participate in the many activities that were offered to them during their time with the program.

Summary

Overall, the S-STEM program at Purdue University Northwest-Calumet Campus (formerly Purdue University Calumet) was successful in providing a pathway for many talented STEM students who were in need of financial help. The effectiveness of the program, in particular, was shown by comparing the students who participated in the program and those who did not. The major differences were in percentage of underrepresented minorities (e.g., 36% vs. 27% for Fall 2013); female participation on average (19.5% vs. 13.5%); and an average beginning GPA for all semesters of 3.38, as opposed to 2.79. When considering all students in the program who eventually earned a B.S. degree in a STEM field, including students who transferred to a

different campus or who changed majors to a STEM field outside of the disciplines supported by the program, 92% of the 59 participants achieved that goal.

Acknowledgements

The authors would like to thank the National Science Foundation, Directorate of Education and Human Resources, Division of Undergraduate Education for its support (Award #0806831) and for prior CSEMS Awards, which enabled this work (Awards #0094852 and #0324017).