

AC 2010-816: S-STEM: ENG² SCHOLARS FOR SUCCESS ENGINEERING ENGAGEMENT

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S-STEM ENG² Scholars for Success Engineering Engagement

Abstract

The National Science Foundation (NSF) sponsored Louisiana State University S-STEM scholarship project in the College of Engineering (CoE) provides monetary, academic and community support to academically talented and financially needy engineering students while targeting women and ethnic minorities. The ultimate project objectives are to provide support to the recipient scholars so they can complete a degree in engineering/construction management (E/CM) and increase the percentage of women and minority E/CM students.

The project encompasses three major components: recruitment, retention and placement. Recruitment consisted of communications with high school counselors, direct mailings to candidates, and collaboration with high school math and science teachers and college faculty. While the recruitment and awards were focused on financial need and under-represented groups, the program was open to anyone with a demonstrated financial need. Retention efforts leveraged components implemented as part of the existing NSF STEP Project within the college. The suite of engineering STEP retention activities/programs includes peer mentoring, summer engineering enhancement camp, academic tutoring, faculty development and a freshmen introduction to engineering course (ENGR 1050). New retention activities developed specifically for the S-STEM scholars program include a seminar series held in the fall and a spring seminar series, ENGR 2050, and the development and implementation of a summer jobs program. Additionally, the CoE Diversity staff conducted monthly, individual meeting with the scholars to establish a relationship with the student and identify problem areas early.

The S-STEM scholarship project in the CoE at Louisiana State University (LSU) was funded in August 2007 and has entered the second year of scholarship implementation (August 2009). Initially, financial support was provided to 20 incoming freshmen, and four students with junior standing for the fall 2008 cohort. Two freshmen were added in spring 2009 to replace those who left the program that semester. The fall 2009 cohort consisted of eight incoming freshmen and five students with upper level standing. The scholars program demographics support the targeted under-represented students.

Retention of students in engineering is a primary goal of the project, and of all 22 students who were part of the S-STEM 2008 freshmen cohort, only four changed majors, three in a STEM discipline and one in mass communication. One student who continued in engineering transferred to a smaller university at the end of the fall 2008 semester. This yields a first year engineering retention rate of 82%, as compared to the 11 year historical CoE first year retention rate of 73%. Six freshmen students have not been able to maintain the required GPA of 2.75, although all have remained in E/CM at LSU for the fall 2009 semester.

The S-STEM program has primarily been assessed using student academic performance and a program elements survey completed by students at the end of the spring 2009 semester. The mean cumulative GPA was 2.912 for the S-STEM 2008 freshman cohort, and it compares well with the 2007-2008 academic year GPA of 2.798 for all freshman engineering majors. The upperclassman S-STEM scholars performed well academically, and they had a cumulative GPA

of 3.383. With respect to programs, the students have evaluated the seminars positively. The 2008 freshman cohort reported that they were actively participating in many of the career services (Career Services Center - 88%) and academic assistance programs (Center for Academic Success - 77%) that would impact their academic success, professional development and overall balance of life.

Introduction

Fulfilling the need for college graduates in science, engineering and technology has been identified as a critical element in maintaining the United States' progress and leadership in a competitive, technology driven world economy¹. Unfortunately, overall enrollment in engineering degree programs has declined while attrition rates for those students starting in engineering have increased during the last quarter of the 20th century^{2, 3}. This is happening as the first wave of engineers from the baby boom years prepare to retire from the active workforce; thus, this creates a gap between the insufficient number of engineers (and other scientist & technology workers) entering the workforce and the number of technologically focused researchers and innovators needed to continue economic growth¹.

Nationally, minorities and women continue to be under-represented in the engineering fields⁴, and the ability to increase engineering undergraduate enrollment, persistence and graduation of this group will be necessary to meet the demand for more engineers^{1, 5}. Also, improving the diversity of engineering will lead to a variety of perspectives that ultimately results in optimal, creative solutions to engineering problems⁶. Within the college experience, a more diverse student population generally correlates with improved learning outcomes and experiences for all students⁷.

As students from under-represented groups pursue engineering degrees, the higher education community will need to deliberately address issues that will support recruitment, persistence and increase graduation rates. Across all fields, females attend college and graduate at higher rates than males, but females are far less likely to enter the STEM disciplines. Thus, the initial and major task is to increase recruitment of female students who plan to attend college.⁸ With respect to underrepresented minorities, both low recruitment and retention are barriers to increasing the number of graduates.⁸ Among students who have financial need, a key retention component is providing non-loan based awards that are correlated with higher persistence rates⁵. Additionally, retention of engineering students is shown to improve with programs that engage the students beginning with the first year⁹⁻¹⁴.

Background

The S-STEM ENG² Scholars for Success Program in the College of Engineering at Louisiana State University (LSU) began in August 2007 and has completed 1.5 years of full implementation. Over the course of the grant, it will provide financial support for approximately 32 academically talented, financially needy students including women, underserved minority and first generation students over a two (12 students) or four (20 students) year period. The project encompasses three major components: recruitment, retention and placement. Recruitment has consisted of multiple approaches including communications with high school counselors, direct

mailings to candidates, and collaboration with high school math and science teachers and college faculty. Retention efforts have leveraged components implemented as part of the existing NSF STEP Project-ENG²: Engineering Engagement for Student Success (NSF STEP 0622524). The suite of ENG² STEP retention activities/programs has included mentoring, summer engineering enhancement camp (Encounter Engineering), a freshman engineering residential college, academic tutoring, faculty development, a freshmen introduction to engineering course, and one-on-one mentoring program with the practicing professionals. New retention activities developed specifically for the S-STEM scholars program include a monthly seminar series and the development and implementation of a summer jobs program.

Project Goals & Objectives

The principal thrust of the project has been to recruit and retain under-represented minority and women engineering students (freshmen) who would otherwise encounter difficulty attending LSU due to the lack of adequate financial resources. The basic objective of this ongoing project is to provide financial support to academically talented and financially needy ethnic minority and women engineering students who, through academic activities and services via ENG² and scholarship aid from the S-STEM ENG² project, can complete a degree program in engineering or construction management and be placed in the engineering workforce or graduate school. In 2007, female, undergraduate engineering enrollment at LSU was 15.7% and under-represented minority undergraduate enrollment, which includes African American, Hispanic and Native American students, was 10.1%, and these numbers are below the national average. Successful implementation of this program will increase the percentage of engineering and construction management students who are women and minorities.

Program Elements

Scholarship Parameters and Eligibility

Initially, 20 freshman students in the program would be supported for a period up to four years and 12 students in their sophomore/junior/senior year would be supported for a period of two years. The initial scholarship amount was set at \$3,500 per year for each student with annual merit increases of \$1,000 based on overall performance. The maximum award is determined annually by the LSU Office of Student Aid and Scholarships using federally mandated rules based on cost of attendance, expected family contributions and total financial package. Academically, students are required to maintain a cumulative GPA of 2.75 on a 4.0 scale in all course work, and as students progress, they are expected to maintain a 3.0 GPA in engineering course work. All students are required to actively participate in program activities. If a student does not meet these criteria, they are placed on scholarship probation for one semester with funding at the same level. If the criteria are met at the completion of the probation semester, the student remains as a funded scholar, and if criteria are not met, the student is no longer funded.

Scholarship Marketing and Application

The S-STEM ENG² Scholars for Success applications and subsequent evaluations (incoming freshmen and upper level students) were modeled after several other scholarship programs

administered by the Office for Diversity Programs in the College of Engineering at LSU. Two cohorts of freshmen and upper level students have entered the program. The 2008 cohort was composed of 20 freshmen entering the university fall 2008 and four upper level students, and promotion of the program started early 2008. The 2009 cohort consisted of eight freshmen and five upper level students.

The first incoming freshman application was posted on the LSU College of Engineering's website in January 2008 under Prospective Students, Freshman Scholarships. The freshman application packet is located in Appendix I. Several other forms of marketing were also used to ensure an adequate women and minority applicant pool. First, flyers were handed out at State Counselor Association Annual Conference, held October 2007. The College of Engineering staff discussed this opportunity with high school counselors and encouraged them to nominate students (in particular women and minorities) for the scholarship. Second, the College of Engineering staff was invited to the Women's Energy Network Recruitment event in Houston, Texas, November 2007. A presentation was made and flyers handed out alerting high school teachers, students and parents to the S-STEM Scholarship opportunity. Third, LSU launched a new "one-stop" shopping (electronic) for admissions application submission and scholarship application process. A scholarship query software system was made available beginning January 2008, and this software allowed College of Engineering staff to run queries on all students admitted for fall 2008. Queries were performed to identify all women and minority students who declared an engineering or construction management discipline. Personal letters (approximately 300) were sent to these students, along with an application packet and scholarship criteria, informing them of their possible eligibility for the S-STEM scholarship.

The first upper level scholarship application packet was placed on the College of Engineering website on April 2008, and the upper level application packet is located in Appendix II. Also, academically qualified applicants were identified by GPA and classification, and an application packet, including description of award, selection criterion and criterion to maintain eligibility was e-mailed to these students.

A second cohort of scholars was targeted for the 2009-2010 academic year. Eight scholarships were available for engineering students who entered the university as freshman in the fall of 2009. The freshmen scholarships became available as a result of two students changing majors at the end of the spring semester and six 2008 freshman students not achieving the required 2.75 cumulative GPA after one semester of scholarship probation. Thus, they were no longer eligible to receive monetary awards, but they could continue to participate in all other S-STEM activities. Five scholarships were available for upper level engineering students (four juniors and one senior). The application materials and information for both freshmen and upper-level students were posted on the Office for Diversity Programs website and multiple flyers and emails targeting under-represented engineering students were distributed similar to the first year promotions.

Participants

Applicants (2008 Freshmen). A total of 77 scholarship applications were received for the 2008 freshman scholarship cohort. The demographics and academic indicators of the applicant pool were collected (Table 1). The majors declared by the total freshman applicant pool were from nine of the ten engineering and construction disciplines in the CoE, and 10 students indicated other majors (Figure 1). The majority (58%) of the applicants resided in The STATE, and the remaining applicants were from nine other states and two countries.

Student applicants were reviewed in three stages. First the application packages were examined for completion and adherence to scholarship requirements. The students who had demonstrated financial need based upon the cost of attendance versus family contributions were then placed into the eligible applicant pool. At this stage, 30 applications were declined due to an incomplete application or the applicants did not demonstrate a financial need. Next, applications

Table 1. S-STEM 2008 freshman total applicant pool academic indicators and demographics (n=77).

Description	Number	Range/Percent
Mean H.S. GPA	3.74	2.97 – 4.54
Mean ACT	26	20 - 35
Female	40	52.0%
Male	37	48.0%
African American	35	45.4%
Asian American	8	10.4%
Caucasian	8	33.8%
Hispanic	26	10.4%

were reviewed and scored across six categories (Table 2). The freshman ranking form is located in Appendix III A total of 6 LSU CoE and Office for Diversity Programs staff members evaluated the complete applications and reviewed the students’ essays. Lastly, the applicants were rank ordered based on the total point score for all criteria categories. Once the applicants were rank ordered, the selection committee met and discussed each applicant. Based on the discussions regarding the rankings and financial aid status of each applicant, the first 20 applicants were selected and offered scholarships.

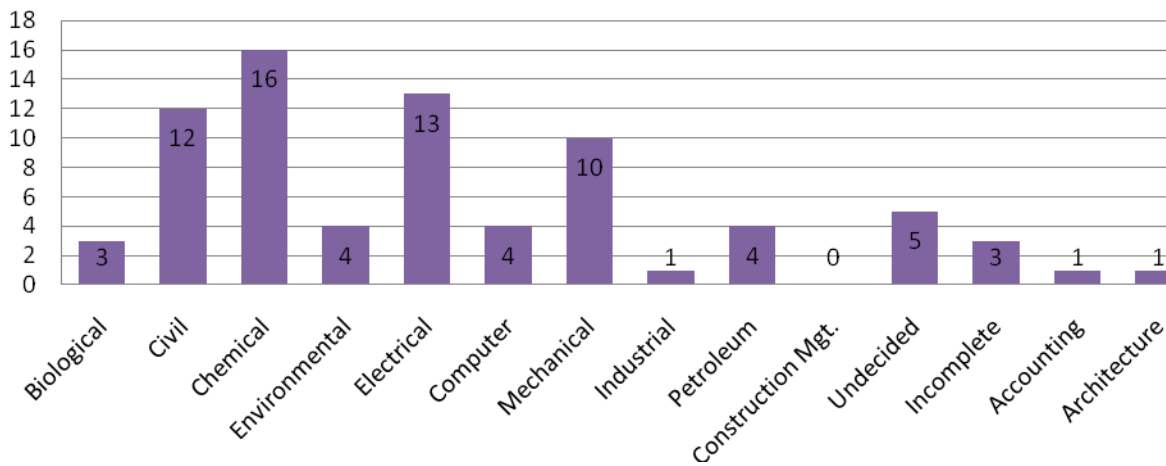


Figure 1. Engineering majors indicated by the 2008 S-STEM freshmen applicant pool (actual number).

Of the first 20 scholarship offers extended, 17 acceptance letters were received. Several reasons were given for declining of the scholarship, i.e. better financial offers from other universities or LSU was not their first collegiate choice. The scholarships were either declined by verbal confirmation or the applicants did not respond in any form by the deadline. This resulted in three available slots, and offers were extended to the next top applicants on the contingency list until all 20 slots were filled. During the summer and prior to the start of the fall 2008 semester, five more incoming freshmen who initially accepted the S-STEM scholarships either did not attend the university or changed their major. These available scholarships were then offered to the next five eligible candidates.

Incoming Freshman Cohort 2008. A total of 20 scholarships valued at \$3,500 each for the 2008-2009 academic year were awarded to incoming freshmen. The declared majors distribution (Figure 2) and demographics (Table 3) for this cohort of S-STEM freshman scholars indicate they are academically qualified and under-represented groups were successfully recruited. The fall 2008 entering freshman (LSU overall) had a mean ACT score of 25.3, essentially the same as the S-

Table 2. Rating criteria developed for 2008 freshman applicants.

Evaluation Criteria	Point Values
Letters of Recommendation	20
Essay Score	40
Community Service	25
Extra Curricular	10
Awards and Honors	20
First Generation	5
Total Possible Points	120

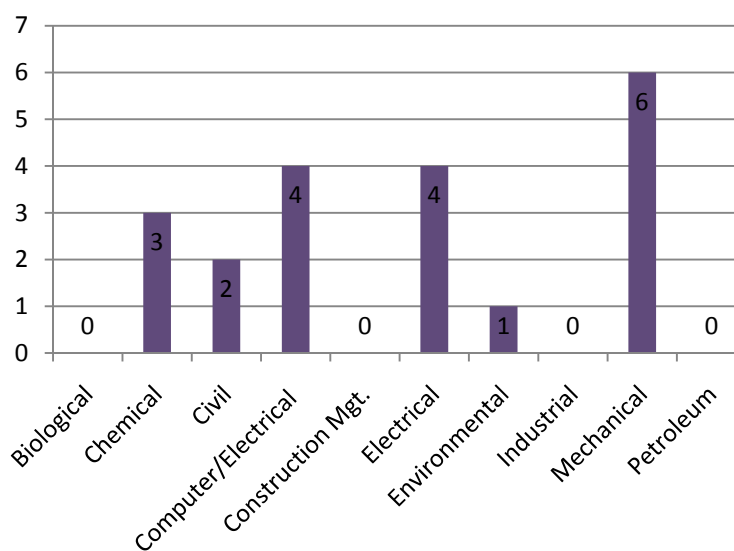


Figure 2. S-STEM fall 2008 entering freshman scholars declared majors.

Table 3. S-STEM fall 2008 entering freshman scholars' demographics (n=20).

Description	Number Range/Percent		CoE	University
	S-STEM			
Mean H.S. GPA	3.73	3.00-4.26	3.4	-
Mean ACT	25.4	21-33	26.5	25.3
Female	5	25%	18.1%	53.3%
Male	15	75%	81.9%	46.7%
African American	13	70%	8.2%	9.0%
Asian American	1	5%	3.8%	3.3%
Caucasian	5	25%	79.2%	79.8%
Hispanic	1	5%	3.72%	3.2%

STEM scholars. All 2008 entering engineer majors had a mean ACT score of 26.5. The S-STEM freshman chose majors from 6 of the 10 discipline areas offered in the CoE (Figure 2).

After the fall 2008 semester, two students in the program were no longer qualified participants. One student changed their major from electrical and computer engineering to a non-engineering STEM discipline, and the other student majoring in electrical engineering transferred to another university. Both students were African American males. The two open scholarships (pro-rated for one semester at \$1,750) were allotted to previous applicants. One was an African American male majoring in mechanical engineering and was an original selection that declined the S-STEM scholarship. The other student joining the program was a Caucasian female majoring in environmental engineering.

Upper Level Applicants and Cohort Fall 2008. The program received a total of 34 applications for the upper level S-STEM scholarship during summer 2008. Each applicant was evaluated according to financial need, academic merit and leadership, and they were ranked according to the Upper Level Scholarship Rubric by the same scholarship panel that ranked the freshman applicants. The categories and point scales for the upper level student criteria (Table 4) differed from the freshman criteria and considered desired qualities of experienced students. The demographics of the total applicant pool were collected (Table 5), and majors from 9 of the 10 disciplines in the CoE were represented (Figure 3). The ranking form is located in Appendix IV. In addition to the students' statement of financial need, the applicants' unmet financial need was obtained from LSU Office of Admissions and Student Aid.

Table 4. S-STEM fall 2008 upper level scholarship selection criterion.

Evaluation Criteria	Point Scale
Community Service	25
Membership List	10
Leadership Positions	20
Awards and Honors	30
Work Experience	30
Essays	100
First Generation	5
Total Possible	220

Table 5. S-STEM fall 2008 upper level scholarship total applicant pool demographics.

Description	Number	Range/Percent
Mean GPA (n=34)	3.285	2.704-4.000
Female	21	61.8%
Male	13	38.2%
African American	18	52.9%
Asian American	0	0.0%
Caucasian	15	44.1%
Hispanic	1	2.9%

The pool of applicants was evaluated and narrowed to ten students who were then interviewed via phone. The top four applicants were selected and notified, and each student accepted the scholarships for \$3,500 for the 2008-2009 academic year. All recipients were female; three were African American and one was Caucasian. There were two chemical engineering majors and two electrical engineering majors, and their classification at selection was two sophomores, one junior and one senior. The mean overall GPA for the selected scholars at the end of the 2007-2008 academic year was 3.405.

Fall 2009 Upper Level and Freshman Cohort. For the 2009-2010 academic year, five scholarships were awarded to upper level engineering students (four juniors and one senior), and eight scholarships were awarded to engineering students who entered the university as freshman in fall 2009. The senior level engineering scholarship became available when one of the upper level

engineering students was accepted into and transferred to a health sciences program within the LSU system. These new upper level scholars have a mean cumulative GPA of 3.384 and contribute to the diversity of the program demographically (Table 6) as well as engineering majors represented (Figure 4).

At the end of the first year, six freshmen lost scholarships based on academic criteria and two students changed majors.

With funds available for eight scholarships over three years, it was decided that another freshman cohort could be added to the program. The freshmen in the 2009 cohort have a variety of backgrounds (Table 7) and majors (Figure 5), and their academic high school indicators were strong with a mean composite ACT of 27.25 and mean high school GPA of 4.00.

In total, 27 undergraduates are receiving S-STEM scholarships during fall 2009. Demographically, the scholars are 52% female and the majority is African American (Figure 6). All LSU engineering disciplines except CM are represented in the group (Figure 7).

Activities

The ENG² scholars program and the college wide NSF STEP program, (0622524) have cooperated with the implementation of activities that benefit each project. The STEP project began in January 2007 and has three cohorts of students, freshman 2007-2008, 2008-2009, and

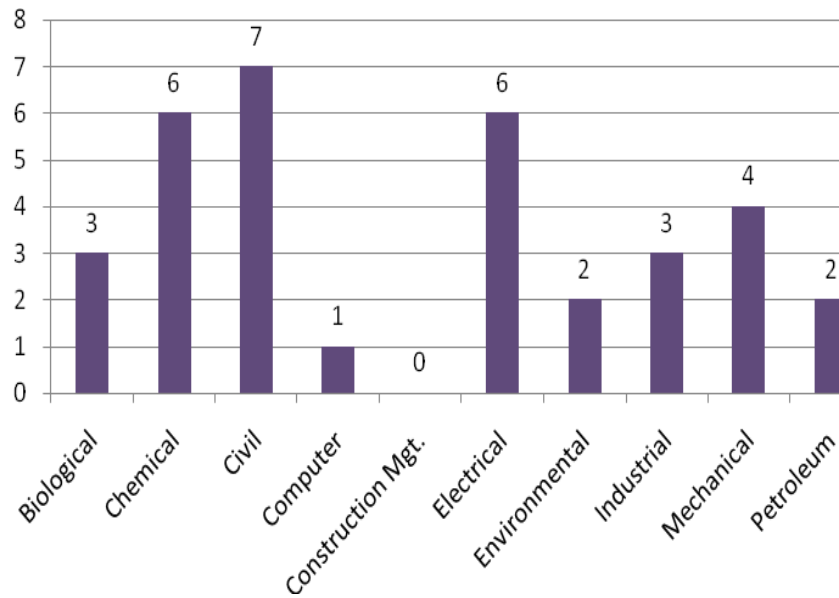


Figure 3. S-STEM fall 2008 upper level total applicant pool declared engineering majors.

Table 6. Fall 2009 upper level cohort cumulative college GPA and demographic data.

Description	Number	Range/Percent
Mean GPA n=5	3.384	3.113-4.000
Female	3	60.0%
Male	2	40.0%
African American	2	40.0%
Asian American	1	20.0%
Caucasian	2	40.0%
Hispanic	0	0.0%

2009-2010. The STEP project has three main activities, the bridge camp for incoming freshmen, the expansion of *ENGR 1050: Introduction to Engineering* course, and the faculty development workshop. The freshman 2008-2009 S-STEM scholars were cohorts of the corresponding STEP grant participants and interacted with each other in ENGR 1050 and many lived in the same Engineering Residential College (ERC) for engineering freshmen, which was on off shoot of the STEP project though not funded by the grant.

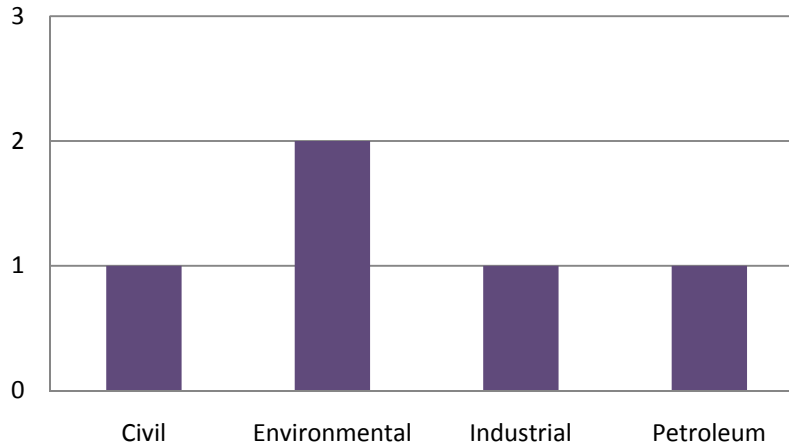


Figure 4. The distribution of majors among the 5 S-STEM upperclassman scholars who entered the program fall 2009.

Table 7. Fall 2009 freshman cohort high school GPA and demographic data.

Description	Number	Range/Percent	S-STEM		CoE	University
Mean GPA n=8	4.00	3.05-4.44	-	-	-	-
Mean ACT	27.2	22-34	-	-	-	25.5
Female	5	62.5%	20.2	51.8		
Male	3	37.5%	79.8	48.2		
African American	4	50.0%	8.6	8.8		
Asian	1	12.5%	3.7	3.3		
Caucasian	3	37.5%	78.4	78.7		
Hispanic	0	0.0%	3.15	3.4		

ENGR 1050. The CoE offers *Engineering 1050: Introduction to Engineering (ENGR 1050)*, and it was expanded under the NSF STEP 0622524 project. This course is designed to assist freshman engineering students

academically and professionally, and all incoming freshmen ENG² scholars were required to enroll in the class. The course provides in-depth information on the types of engineering, career opportunities, degree programs, assistance in the career decision processes, the basics of the engineering design process, and reinforcement of the importance of communication, study habits, teamwork and continued professional development within the engineering profession. Students are required to maintain a design and professional development journal, attend a career fair and work on a team based design project. Total enrollment in the fall 2008 class was 76 students at day 14, and the fall 2009 class enrollment was 64 at day 14.

“Discipline Chats” were held to provide in-depth information about the specific engineering disciplines from several perspectives. This information was delivered by bringing in faculty advisors, representatives from related student organizations and industry professionals.

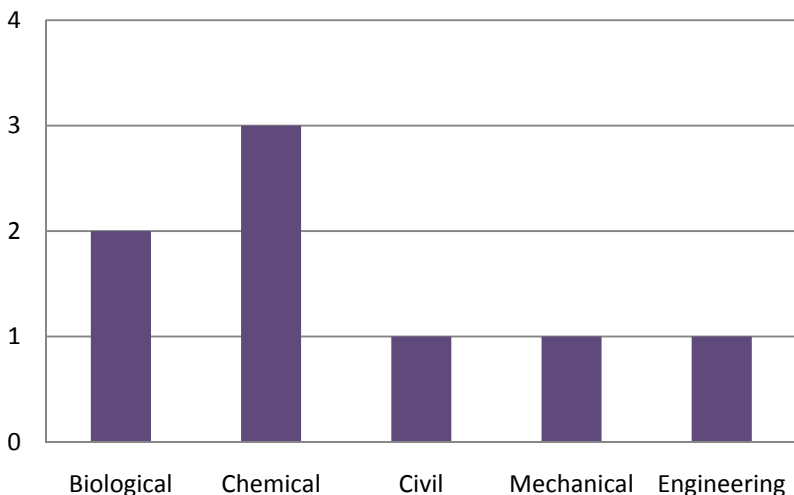


Figure 5. The distribution of majors among the eight S-STEM freshman scholars who entered the program fall 2009.

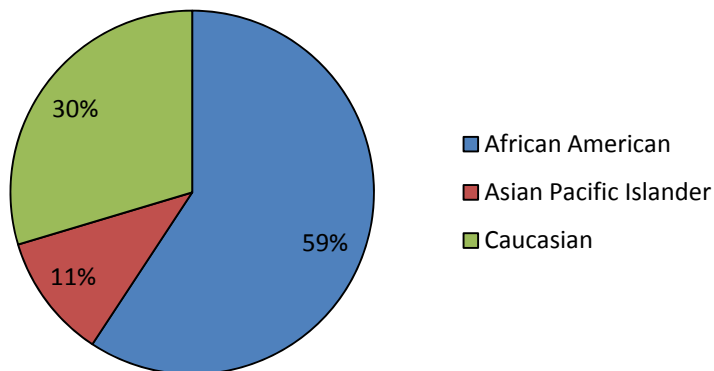


Figure 6. Race/Ethnicity of the 27 S-STEM scholars is shown for student in the program during the fall 2009 semester.

activities (20%) and the design project (40%). At the end of the fall 2008 semester, 61 students were still in the class, and the mean grade was 3.03 on a four point scale. The S-STEM 2008 scholars had a mean grade of 3.33, and the 2009 cohort had a mean GPA of 3.375.

Chemistry. All 2008 freshman scholars enrolled in CHEM 1201 in the fall 2008 semester except for two students who took the honors equivalent of the course. The mean GPA in chemistry for the freshman 2008 S-STEM cohort was 2.91. Only 3 of the eight 2009 freshman cohort enrolled in CHEM 1201/1202, and they had a mean course GPA of 4.0.

With respect to design projects, the fall 2008 student teams chose between designing an educational activity module for K-12 or a hurricane survival kit that was inspired by regional needs and recent natural disasters. The faculty formed the projects teams based in part on the results of the *Myers Briggs Temperament Indicator* that was given to each student.

ENGR 1050 is purposefully designed to provide opportunities for students to meet college advisors, obtain information on various careers, meet other engineering students, start thinking and planning their academic career pathway, develop project and time management skills, and provide opportunities for networking. The bulk of the work was assigned and completed in class, thereby limiting the effort outside of class. The overall grades for ENGR 1050 were based on the design notebook (40%), personal development

Math. LSU places students into appropriate level math classes based on the student ACT math scores and the departmental placement test scores, therefore this cohort was enrolled in a range of math courses from algebra to second semester calculus. Overall, the S-STEM 2008 freshman GPA for math courses was 3.00, with all but two students making at least a “C” or better. The S-STEM 2009 freshman GPA was 3.14, with one student not passing the first semester calculus class.

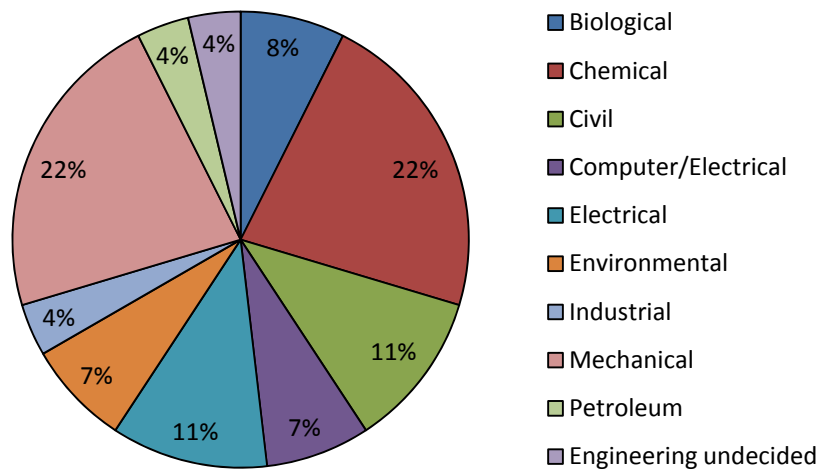


Figure 7. The majors among the 27 S-STEM scholars in the program during the fall 2009 semester are distributed among all LSU engineering disciplines.

Physics. Enrollment in physics classes was limited to only five students in fall 2008 with four students in *PHYS 1101: Introduction to Physics* (a noncredit course for the engineering curriculum) and one in *PHYS 2101: Physics for Technical Students*. Three students completed PHYS 1100 with a mean GPA of 2.33, and the student in PHYS 2101 earned an “A.” Only three students from the fall 2009 cohort enrolled in a physics course. The two students in PHYS 1101 had a mean GPA of 3.0, and the student in PHYS 2101 earned an “A.”

Engineering Residential College (ERC). Ten of the 22 freshmen 2008 cohort were housed in the ERC. The hall has 191 beds; 75% are male and 25% are female. ERC students were required to take three of designated ERC courses in math, physics, chemistry or English. Several faculty members instructing these designated courses have participated in the NSF STEP 0622524 supported Faculty Development Workshops and Learning Communities. The designated ERC courses included onsite tutoring and review sessions, academic advising and personal develop activities throughout the semesters. Engineering industry recruiters and engineering alumni visit students in the ERC to discuss career opportunities, the engineering community, and professionalism in engineering. Faculty and advisers in each engineering department visit the students in the ERC to present the curriculum including concentrations, electives, scholarships and graduation data.

Academic and Professional Seminar Series Fall 2008. In addition to coursework, the S-STEM scholars were required to attend monthly seminars during the academic year. The fall 2008 series was held in conjunction with the ENGR 1050 course and consisted of four presentations that covered skills needed for attaining employment. Speakers from LSU and industry participated in seminar talks. The details of the S-STEM sponsored series are given in Table 8.

Academic and Professional Seminar Series Spring 2009. A new motivational seminar series was introduced in the spring of 2009 and consisted of seven presentations during the semester. To ensure that the S-STEM cohort would be available for this seminar, a new, non-credit course, ENGR 2050, was developed, and the S-STEM students registered for the course so that a common day and time was open during the semester. The seminar series featured successful local, national and LSU women and minority graduates who serve as role models for the S-STEM scholars. Research shows that students are more receptive and dedicated to educational studies when there is a mentor or role model that shares a similar cultural background.

The speakers included experts from wellness, career services and academic success fields to help the students to grow holistically, not only as engineers but as adults. The seminar topics covered balancing life and academics, community service, leadership, graduate school, entrepreneurship, science research and teamwork, and the details of each session are given in Table 9. The final meeting of the students featured a relaxed chat with graduating engineering students as a means of passing along wisdom.

Academic and Professional Seminar Series Fall 2009. The fall 2009 seminar series consisted of six seminars covering many of the previously covered topics, but the material was presented as either a refresher or expansion of previous seminars. Also, the students invited to participate were expanded to include other Diversity Program Scholars and the students served by the program office. The details of each session are given in Table 10.

Tutoring and Advising. S-STEM Scholars were also offered enhanced academic support through expanded tutoring, coordinated study groups and academic advising. Expanded tutoring was provided through four sources, the College of Engineering, the Minority Engineering Program, the Women in Engineering Program and the Center for Academic Success. There was a

Table 8. The S-STEM fall 2008 seminar series focused on professional skills.

Topic	Title	Presenter	Affiliation
Career Services and Resumes	“Getting Started Early”	Don Howard, Associate Director	LSU Career Services
Career Fair 101	“Be Effective”	Julie Harris	LSU Engineering Diversity Programs
Interviewing Skills	“Making the Best Impression”	Del Dugas and Robert Douglas	ExxonMobil
Engineering Professional Licensure	“P.E. or Not to P.E.”	Donna Sentell	LAPELS

Table 9. The S-STEM spring 2009 professional skills series featured leaders from LSU, the local community and the national level.

Topic	Title	Presenter	Affiliation
School and Life Balance	“How to Excel at LSU ...and Still Have a Life.”	Diane Mohler	LSU Center for Academic Success
Community Involvement	“Community Engagement”	Jan Shoemaker	LSU Center for Community Engagement, Learning and Leadership
Campus Involvement	“Leadership, Involvement and Balance”	William Gunn	LSU Campus Life
Graduate School	“Why Graduate School for Engineers?”	Panel Discussion	LSU
Business of Engineering	“Engineering Entrepreneurship”	Panel Discussion	Local Industry & Business Leaders
Teamwork & Individual Goals	“Are you a Team Player?”	Travis Mays	LSU Women’s Basketball Assistant Head Coach

combined support of up to 20 tutors that assisted with engineering and math courses. Engineering 1050 fostered the formation of the coordinated study groups. Also, many of the S-STEM scholars were able to secure housing in the freshman Engineering Residence Hall that provided onsite tutoring

As recipients of scholarships offered through the CoE Office for Diversity Programs, each scholar was required to meet with the staff approximately once per month or more frequently if the student was experiencing challenges. Each student meeting covered critical areas for being a successful student, and the staff member utilized a “Retention Interview Form,” and current student academic records. Areas discussed included intellectual, social, physical, spiritual and emotional. If a particular concern was identified during the interview, the staff advisor would help develop a plan of action.

Employment. The optional summer jobs program for the S-STEM scholars has been developed to help the students develop “real life” exposure to the engineering field of their choice. The first component encouraged students to prepare and develop job skills prior to their initial summer job, and this was done primarily through the ENGR 1050 and ENGR 2050 courses. The scholars were encouraged to register for training workshops through the Center for Academic Success’

Table 10. The S-STEM fall 2009 professional skills series featured leaders from LSU and the local community.

Topic	Title	Presenter	Affiliation
Welcome & Expectations of Scholars	“The Meeting of the Elite”	CoE Staff	LSU CoE
Career Services & Resumes	“Career Essentials I”	Career Services Staff	LSU Career Services
Career Networking, Career Expo	“Career Essentials II”	Career Services Staff	LSU Career Services
Nutrition & Fitness	“Health & Fitness for Success”	Staff	LSU Wellness Center & University Recreation
Mid-semester Academic Improvement	“Search & Rescue”	Staff	LSU Center for Academic Success
Advice from graduating students	“Take a Breath”	Students	LSU

START Program, which trains students in several computing areas: web development and programming, multi-media and graphics, productivity software and operating systems.

The second component involved making contacts with potential employers and working with LSU Career Services so students can be matched with internships that will provide valuable experience in their field of engineering. Unfortunately, economic conditions hindered the placement of the 2008 freshman cohort in the engineering sector. Also, seven students chose to either pursue academic coursework or summer research experience, and some returned to other jobs that are available during the summer. One student was placed as an engineering intern with a major engineering firm with local corporate headquarters, while one student secured an internship with an international corporation.

Assessments

At this point of program implementation, the S-STEM program has primarily been assessed using student academic performance and program elements surveys completed by students at the end of the fall 2008 and spring 2009 semesters. The S-STEM 2008 freshman cohort mean GPA for each semester and the cumulative GPA at the completion of the first year at LSU were calculated and included students who were placed on scholarship probation during the spring 2009 semester (Table 11). The first-year, mean cumulative GPA was 2.912 for the S-STEM 2008 freshman cohort and compares well with the 2007-2008 academic year GPA of 2.798 for

Table 11. Three semesters of GPA data for the freshman S-STEM 2008 cohort was summarized.

	Fall 2008 GPA (n=20)	Spring 2009 GPA (n=20)	1st Year Cumulative GPA (n=20)	Fall 2009 GPA (n=12)
Mean	3.080	2.600	2.912	2.654
Minimum	1.940	0.545	1.500	1.500
Maximum	4.000	4.000	4.000	4.000

all freshman engineering majors at LSU. The fall 2009 GPA data for the cohort indicates that as a group, students are being challenged academically. The fall 2009 freshman cohort performed well with mean GPA of 3.193 (n=8), and only one student did not meet the 2.75 GPA requirement and will be placed on scholarship probation.

The 2008 upper level S-STEM scholars have performed well academically, and as a group they had a cumulative GPA of 3.383 at the end of the spring 2009 semester. Three of these students will be graduating in the 2009-2010 academic year, and two of them have received and accepted employment offers with leading corporations. The 2009 upper level cohort had a fall semester mean GPA of 3.308 for the fall 2009 semester, the mean GPA for all upper-level scholars was 3.273.

The S-STEM students completed a survey at the end of the spring 2009 semester that had them evaluate specific topics covered in the ENGR 2050 Professional Skills Seminar (Table 9). They were also requested to rate the seminar series overall, to report various activities and to provide comments. Each student was requested to rate each seminar topic for interest and application on a Likert scale, with 1 being least interest or no application and 5 being the highest interest or highest application. The mean results were calculated for both interest and application (Figure 8). The highest rated topics were the inspirational talk with Coach Mays, 4.8 and the informal chat with the graduating engineering students, 4.8. Typically, the interest and application ratings for the topics matched closely, although the Career Expo exhibited the biggest difference with a 4.1 rating on interest and only at 3.5 rating on application. Students were also requested to report on various activities that would impact their academic success, professional development and overall balance of life. The reported activities also relate to the seminar topics covered in ENGR 1050 and ENGR 2050. The results were tabulated and are presented in Table 12. As freshmen, the group is actively participating in many of the career services and academic assistance programs. It is interesting to note that 59% of the students reported that they believed that the amount of time (mean = 13.3 hours/week) devoted to studying outside of class was adequate. This indicates a possible disconnect between hours studying and the drop in the mean spring 2009 GPA (2.600) compared to the fall 2008 GPA (3.080).

Retention of students in engineering is a primary goal of the project, and of all 22 students who have been part of the S-STEM 2008 freshmen cohort, only three have changed majors, two in a STEM disciplines and one in mass communication. One student transferred to a smaller university at the end of the fall semester, but he was still planning to major in engineering. This yields a first year engineering retention rate of 81.8%. This compares favorably to the 11 year

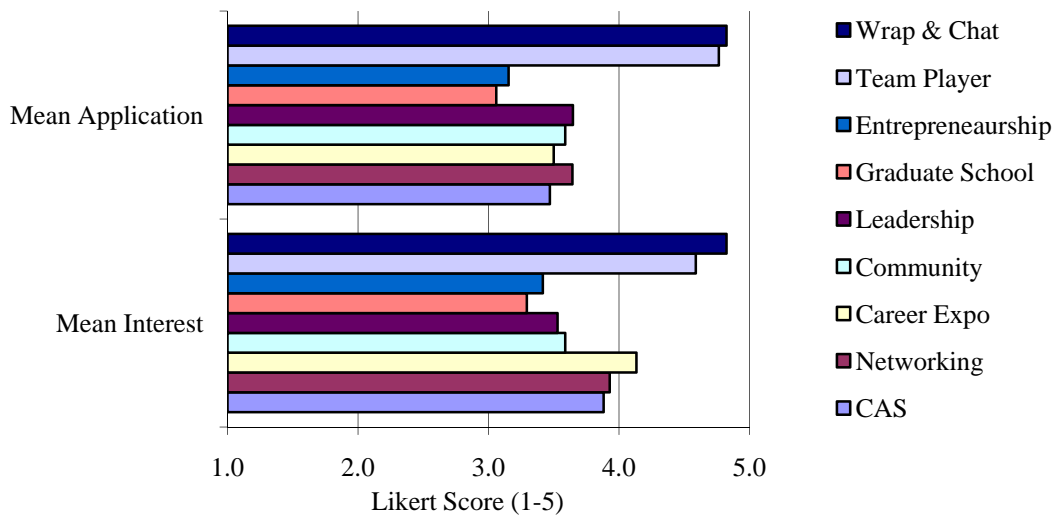


Figure 8. S-STEM students rated the spring 2009 ENGR 2050 seminar topics.

historical CoE retention rate of 73% and the 2007/2008 academic retention rate of 74.1%. Of the fall 2008 cohort, 90% remain in a STEM discipline and 95% were enrolled in LSU at the beginning of the fall 2009 semester. Six students in the 2008 freshman cohort were placed on scholarship probation for the spring 2009 semester as a result of their cumulative GPA falling below 2.75. None of these students were able to raise their cumulative GPA to the required 2.75, but all have remained engineering majors as of fall 2009.

Conclusion and Future Plans

The first year data suggests that the S-STEM program is providing the needed support to assist the target student population to pursue an engineering degree. Academic performance of the fall 2008 freshman cohort indicates the students were experiencing the anecdotal sophomore adjustment to more rigorous course work as many are taking their first engineering courses.

Returning scholars will receive an increase in funding of approximately \$1000 per academic year (\$2,500 for fall 2010 and \$3,000 for spring 2011). These increases are dependent on the individual scholar fully participating in all elements of the program and meeting the GPA requirements. Students will also be expected to increase their level of leadership as they progress through the program and participate in the support programs. The upper level scholars are expected to participate in several possible activities that place them in leadership roles. These include peer mentoring and conducting outreach activities.

An overall schedule of program events have been outlined for the academic year incorporating results of surveys, student suggestions and the academic needs of the scholars. The main goal of the seminar talks and activities is to continue informing and directing the students to become successful students and engineers and reinforcing previously presented material. Several of the

events will leverage resources of other complementary programs within the Office for Diversity Programs, the CoE and LSU.

Table 12. S-STEM students (n=17) reported activities are summarized for fall 2008 and spring 2009.

Activity	Fall 2008		Spring 2009	
	Number	Percent Indicated	Number	Percent Indicated
Utilized Career Services*				
Career Fair	14	82%	15	88%
Career Reception	8	47%	12	71%
Campus Events	8	47%	8	47%
Other	2	12%	0	0%
Extracurricular Activities *	12	71%		
activity 1			7	41%
activity 2			3	18%
Communication across the Curriculum Studio	5	29%	2	12%
Center for Academic Success*	10	59%	12	71%
Chemistry	-		3	18%
Math	-		3	18%
Physics	-		3	18%
Other	-		7	41%
Students Working Hours/ week			7	41%
			15.1	-
Study hours/week Adequate	10	-	13.3	-
	7	59%	10	59%
Career Development*				
Register	11	65%	10	59%
Activities	8	47%	6	35%
Interview	6	35%	6	35%
Received Job Offer	1	6%	3	18%
Summer Plans*				
Courses			7	41%
Internship			6	35%
Other job			11	65%

* Totals may be greater than 100% since students could indicate multiple programs/answers.

Acknowledgement

This material is based upon work supported by the National Science Foundation under Grants No. 0728472 & 0622524. Any opinions, findings, and conclusions or recommendations

expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.

References

1. Jackson, S.A., (2002). "The Quiet Crisis: Falling Short in Producing American Scientific and Technical Talent," Washington, D.C., Building Engineering and Scientific Technical Talent (BEST), September 2002.
2. Besterfield-Sacre, M., Atman, C. J., and Shuman, L. J. (1997). "Characteristics of Freshman Engineering Students: Models for Determining Student Attrition in Engineering," *Journal of Engineering Education*, April 1997, 139-149.
3. Astin, A. W., 1993, *Engineering Outcomes*, ASEE Prism, September 1993, 27-30.
4. Tan, D. L., (2002). "Majors in Science, Technology, Engineering and Mathematics: Gender and Ethnic Differences in Persistence and Graduation," Paper presented at the 42nd. Annual Association for Institutional Research (AIR) Forum, Toronto, Canada on June 3-6, 2002.
5. Fenske, R. H., Porter, J. D., and DuBrock, C. P., (2000). "Tracking Financial Aid and Persistence of Women, Minority, and Needy Students in Science, Engineering, and Mathematics," *Research in Higher Education*, Vol. 41, No. 1, 2000.
6. Wulf, W.A., (2002). *The Importance of Diversity in Engineering*, Washington, D.C.: National Academy Press.
7. Chang, M. J., Astin, A. W., and Kimm, D., (2004). "Cross-racial Interaction Among Undergraduates: Some Consequences, Causes, and Patterns," *Research in Higher Education*, Vol. 45, No. 5, August 2004, 529-553.
8. Andrew, C. L. and Wilkins, L., (2004). "Implementing Institutional Change to Increase Engineering Diversity," *Proceedings of the 2004 Society for Engineering Education Annual Conference & Exposition*, Session 1430.
9. Johnson, K. K., et al. (1997). "Focus groups: A Method of Evaluation to Increase Retention of Female Engineering Students," ERIC Documentation Service No. ED399875 Online, ERIC, February.
10. Tinto, V. (1997). "Classrooms as Communities: Exploring the Educational Character of Student Persistence," *Journal of Higher Education*, 68, 599-623.
11. Tinto, V. (1998). "Colleges as Communities: Taking Research on Student Persistence Seriously," *Review of Higher Education*, 21, 167-177.
12. Tinto, V. (2002). "Taking Retention Seriously: Rethinking the First Year of College" *NACADA Journal*, 19, 2 (Fall), 5-10.
13. Brown, Shane (2005). "Student Social Capital and Retention in the College of Engineering", *Proceedings, American Society for Engineering Education Annual Conference and Exposition*.
14. Downs, C. (2006) "What Should Make up a Final Mark for a Course? An Investigation into the Academic Performance of First Year Bioscience Students," *Assessment & Evaluation in Higher Education*, Vol. 31, No. 3, pp.345-364.

Appendix I. S-STEM: ENG² Scholars for Success Freshman Application

S-STEM: ENG² Scholars for Success

Scholarship Application for Engineering Majors

The LSU S-STEM: ENG² Scholars for Success is an award based on supporting academically talented undergraduate engineering/construction management students of diverse backgrounds who demonstrate a need for additional financial assistance. S-STEM Scholars will be required to participate in mentoring and seminar activities during the academic year and engineering internships and jobs during the summer. Scholars must maintain high academic standards in order to remain in the program, as well as fulfilling program requirements, including enrolling in monthly seminars (non-credit) designed to facilitate their success as students, mentors and engineers.

The S-STEM scholarship is per academic year, and the amount awarded will be based on this application in conjunction with the **completed Free Application for Federal Student Aid (FAFSA), which is required to determine financial need and is submitted separately**, and the LSU application. S-STEM Scholars will retain their scholarships as long as they maintain a GPA>2.75, participate in required S-STEM Program activities and earn an average of at least 12 credit hours per semester. Only U.S. citizens and permanent residents are eligible for S-STEM Scholarships. Scholarship recipients who change to a major outside of engineering will relinquish the remainder of the scholarship.

The S-STEM scholarship application packet consists of:

- This application form completed by the applicant (sent by applicant)
- Essay answers of two questions from the three initial application questions (sent by applicant)
- Student Academic and Extracurricular Activities Summary (sent by applicant)
- Two letters of recommendations with the applicant recommendation form completed. It is important that each of your recommenders submits *both* a completed recommendation form and letter of recommendation printed on official letterhead and place in sealed envelope. We are unable to accept incomplete recommendations. (sent by recommender)

All application materials are ***DUE FEBRUARY 28, 2008***, and become the property of the S-STEM: ENG² Scholars Program and will not be returned. The *FAFSA should be completed ASAP!*

1. Name _____
Last First Middle

2. LSU E-Mail Address _____

3. LSU ID # _____

4. Telephone numbers: Home ()__-____; Mobile ()__-____.

5. Mailing Address _____

6. High School _____

7. Engineering Major Planned / Minor _____

8. List the names, phone numbers and email addresses of two of your teachers or other qualified persons who will submit a letter of recommendation and comment on your capabilities in math, science or engineering. ***Do not send letters of recommendation.***

9. Essay: An important part of this application is the essay section that answers 2 of the 3 questions. Place your name and LSU student number at the top of each page. When answering the essay, you are to *use a separate page for each question answered* and restate the question at the top of the page. Additionally, *the essay must be typed using Times Roman or Arial font size 12 and margins set at 1 inch. Answers are to be limited to ~ 250 words for each question*, and they should describe your interests and experiences, as they relate to science, mathematics or engineering. This essay may contain any additional information that you consider relevant to your application. Attach your essay to this application.

10. Complete the Student Academic and Extracurricular Activities Summary (leadership positions and the most relevant activities should be emphasized)

With my signature I certify that the application information is true to the best of my knowledge and that I am a citizen or permanent resident of the United States. I duly acknowledge that failure to provide truthful information could result in the rejection of my application and possible termination from the program.

Signature: _____

Date: _____

Send all application materials to:

*LOUISIANA STATE UNIVERSITY
College of Engineering*

S-STEM Scholarships are funded in part by the National Science Foundation.

S-STEM RECOMMENDATION FORM RECOMMENDER PAGE

INSTRUCTIONS TO RECOMMENDER:

We appreciate your willingness to serve as a reference for this student applying to the S-STEM: ENG^2 Scholars for Success Program, funded by the National Science Foundation. This scholarship is seeking to support students who will be able to successfully fulfill the scholastic requirements of the program and have unmet financial need with respect to starting and completing an undergraduate degree in the College of Engineering.

Please attach both pages of the form (Applicant and Recommender) to a separate Letter of Recommendation on official letterhead detailing the candidate's qualifications. Seal it, sign across the seal, place in a mailing envelope and mail it directly to *Office of Diversity Programs, LSU, College of Engineering*,

RECOMMENDER: PLEASE PRINT THE INFORMATION REQUESTED BELOW

How Long Have You Known This Applicant? _____ Your Email Address: _____

Print Your Name _____ Position or Title

Relationship to Applicant _____ Daytime Phone Number

Mailing Address _____ City _____ State/Zip _____

This recommendation form and the accompanying letter must be received by February 28, 2008. Incomplete or late recommendations will jeopardize the applicant's consideration for this major scholarship program at LSU.

Please compose a separate letter of recommendation printed on university, high school or agency letterhead that addresses one or more of the following topics:

- The applicant's strengths and weaknesses in terms of knowledge, attitude, skills and character
- The applicant's potential as a successful mentor, researcher and leader
- The applicant's commitment to diversity, collaboration and service
- Why you believe the applicant will find academic success as an engineering undergraduate
- Please limit the letter to one page using 12 point Times Roman font

Signature _____ Date

S-STEM: ENG² Scholars for Success

Academic and Extracurricular Activities Summary

Applicant: _____

Academic Honors and Notable Awards:

Award/Honor	Brief description	Awarded by	Date Received

Applicant: _____

Extracurricular Activities and Community Service:

Activity/Service	Brief description	Leadership Role	Beginning Date	Ending Date

S-STEM Initial Application Essay Questions

Name: _____

LSU ID #: _____

1. What is motivating you to become an engineer/construction manager?
2. What are your expectations of the time that will be needed (study time per week and years to graduation) to complete an undergraduate degree in engineering or construction management? Please give thought to time management.
3. What leadership roles have you held during high school? In addition to listing these roles, please explain how you made a difference (i.e., how your leadership or action resulted in an accomplishment that would have not been possible without you).

Appendix II. S-STEM: ENG² Scholars for Success Upperclassmen Application

S-STEM: ENG² SCHOLARS FOR SUCCESS Scholarship Application for Upperclassmen Engineering Majors

The LSU S-STEM: ENG² Scholars for Success is a 2-year award based on supporting academically talented full-time undergraduate engineering/construction management students of diverse backgrounds who demonstrate a need for additional financial assistance. S-STEM Scholars will be required to participate in mentoring and seminar activities during the academic year and engineering internships and jobs during the summer. Scholars must maintain high academic standards in order to remain in the program, as well as fulfilling program requirements, including enrolling in monthly seminars (non-credit) designed to facilitate their success as students, mentors and engineers.

The S-STEM scholarship is per academic year, and the amount awarded will be based on this application in conjunction with **the completed Free Application for Federal Student Aid (FAFSA), which is required to determine financial need and is submitted separately.** The award is proposed to start at \$3000 per year and may increase by \$500 per semester based on the student's performance. S-STEM Scholars will retain their scholarships for the full two years as long as they maintain an overall GPA of 2.75 and an engineering courses GPA of 3.0. The scholarship participant should show evidence of professional development and maturity through involvement in student professional organizations and work experience. Only U.S. citizens and permanent residents are eligible for S-STEM Scholarships. Scholarship recipients who change to a major outside of engineering will relinquish the remainder of the scholarship.

The S-STEM scholarship application packet consists of:

- application form, completed by the applicant;
- a transcript;
- two essays:
 - Essay expressing the need for financial assistance (maximum 200 words);
 - Essay expressing engineering education plans and career goals (maximum 200 words);
- a resume which should include, but is not limited to, the following:
 - List any scholarships/fellowships you currently hold
 - Work Experience
 - Awards and honors received
 - Extracurricular activities

All application materials are ***DUE JUNE 9, 2008.***

If you have any questions, please call at or email wep@LSU.edu.

Send all application materials to:

*Office of Diversity Programs, LSU
College of Engineering*

Appendix III. S-STEM: ENG^2 Scholars for Success Freshman Ranking Form

RANKING FORM FOR FRESHMEN S-STEM APPLICANTS FOR FALL 2008

Applicant Name _____

LSU ID _____

- A. 1st Generation (5)
 - i. Yes....._____
 - ii. NO....._____

- B. Financial need
 - i. Un-met Need _____
 - ii. LSU _____
 - iii. Resource _____
 - iv. Family Contribution _____

- C. High school activities
 - i. Community Service (of 25)....._____
 - ii. Membership List (of 10)....._____

- D. Transcripts
 - i. GPA....._____
 - ii. ACT.....Total _____ Math _____ Verbal _____

- E. Awards and Honors (of 20)
 - i. National academic....._____
 - ii. Local academic....._____
 - iii. National athletic....._____
 - iv. Local athletic....._____

- F. Essays (of 40)
 - i. Interest in engineering..... _____
 - ii. Engineering career goals....._____
 - iii. Well-written....._____
 - iv. Matches/contributes to goal of program....._____

- G. Letters of recommendation (20)
 - i. Letter #1..... _____
 - ii. Letter #2....._____

Interview

Traditional/One-on-one....._____

Panel/Committee....._____

Telephone....._____

Group....._____

Rankings

KR _____ JH _____ VH _____ SD _____ SJ _____ AT _____

Appendix IV. S-STEM: ENG^2 Scholars for Success Upperclassmen Ranking Form

RANKING FORM FOR S-STEM UPPERCLASSMEN APPLICANTS FOR FALL 2008

Applicant Name _____

LSU ID _____

H. 1st Generation (5 points)

- iii. Yes..... _____
- iv. NO..... _____

I. Financial need

- v. Un-met Need _____
- vi. LSU _____
- vii. Resource _____
- viii. Family Contribution _____

J. Collegiate Extracurricular Activities

- iii. Community Service (of 25)..... _____
- iv. Membership List (of 10)..... _____
- v. Leadership Positions (of 20)..... _____

K. Transcripts

- iii. GPA..... _____
- iv. ACT.....Total _____ Math _____ Verbal _____
- v. Classification _____

L. Awards and Honors (of 30)..... _____

M. Work Experience (of 30)..... _____

N. Essays

- v. Educational Plans (of 20)..... _____
- vi. Engineering career goals (of 20)..... _____
- vii. Well-written (of 20)..... _____
- viii. Matches/contributes to goal of program (of 20)..... _____
- ix. Financial Need Statement (of 20)..... _____

Interview

- Traditional/One-on-one..... _____
- Panel/Committee..... _____
- Telephone..... _____
- Group..... _____

Comments: _____

Rankings

KR _____ JH _____ VH _____ SD _____ SJ _____ AT _____