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A NSF-Supported S-STEM Scholarship Program for Recruitment and Retention of Underrepresented Ethnic and Women Students in Engineering

Abstract

This paper describes a scholarship project, funded by the National Science Foundation’s S-STEM Program, to enhance recruitment of underrepresented ethnic and women undergraduate students in engineering. The objective is to use financial aid to attract these populations and provide an academic support environment that will assist in completion of their baccalaureate engineering degree while preparing them for graduation school. The recruiting strategy included using data from the Free Application for Federal Student Aid (FAFSA) form to develop a competitive financial aide award for prospective S-STEM Scholars. We concentrated on students with high need. The University’s Emerging Ethnic Engineers (E³) Program and the College of Engineering Rowe Center for Women in Engineering (RCWE) assisted in identifying qualified candidates. S-STEM Scholars participate in activities executed using the resources and manpower available through the E³ and RCWE programs, and include the following: (1) a Summer Bridge Program, which will provide seven weeks of preparation in Calculus, Physics, Chemistry, and English prior to the students' freshman year; (2) cooperative learning courses in the first year math and science courses; (3) monthly socials which provide an opportunity to interact with successful professionals from industry and academia; (4) supplemental classes in freshmen Calculus, Physics, and Chemistry to provide a solid foundation to build-on; (5) continuation of cooperative learning classes in sophomore in Differential Equations; (6) interacting with a select group of department Faculty Advisors and Project Coordinators during their full undergraduate program; (7) participating in a Corporate Mentoring Program which includes shadowing and opportunity to understand the corporate world and skills needed to succeed in it; (8) participating in a mandatory six-quarter internship and paid cooperative education program, which places students in the work-place; (9) forming a community of learners who have goals and aspirations that are similar to their own; (10) development of a community service component for the S-STEM Scholars; and (11) participating in a special Pathway to Graduate School Program to guide and motivate talented underrepresented engineering students to prepare for and pursue graduate studies. The paper describes the implementation of the project and the evaluation results from the first year of the project.

Introduction

In a world of rapidly changing technology, the knowledge explosion, and the expanding global economy, there is growing concern regarding the American ability to remain competitive [1-4]. In the 2006 State of The Union Address, Former President Bush announced the American Competitiveness Initiative, stressing education as the gateway to opportunity and the foundation of a knowledge-based, innovation-driven economy. However, gaps in race/ethnicity and gender at entry and in completion of science, technology, engineering, and mathematics (STEM) programs indicate the U.S. struggle to develop a diverse workforce that can compete globally. While intervention programs help narrow these gaps, improvements have been incremental. Some studies have shown that underrepresented (i.e., all women and ethnic men) students drop
out of STEM programs at much higher rates. Thus, providing equal access to higher education is necessary but not sufficient to ensure academic success. Colleges and universities must also provide equal opportunity for retention, graduation, and advancement [5, 6].

Underrepresented minority students are often low-income and/or first-generation college students. As a result, many arrive on campus less prepared than others for the academic and social challenges they will encounter. They are less likely to have their own computers; they have less knowledge about the college experience; they are less knowledgeable about college finances and managing their money; they have less understanding of how colleges and universities operate, and at majority institutions, they are less likely to have role models or mentors guiding them. Many ethnic students enrolled at predominantly white institutions feel isolated and lack community connection [7, 8]. In contrast, ethnic students enrolled at historically Black institutions typically have role models and mentors and often consider the university as their second home. However, limited resources and research opportunities affect their learning experiences. Involvement in the academic life of the institution distinguishes undergraduate students who thrive from those who do not [9-12]. Underrepresented students need to be integrated into the academic community earlier in their college careers. Low-income, ethnic students working long hours to cover their expenses have difficulty keeping up their grades and experience higher dropout rates. However, even when they complete a bachelor’s, they may graduate with significant debt, so they do not apply to graduate school [13, 14].

**Need**

Interventions are needed to smooth the transition to college, address cultural conflicts between home and college, and create a supportive learning environment [15]. Effective intervention strategies, some of which are part of this project, include bridge programs [12, 16], a “structured” freshman year [17], mentoring [18], research experiences, and career counseling [19], and creating learning communities [12].

According to ACT Inc., 163 Ohio ethnic students scored 24/36, or higher, on the math section of the ACT during 2005 [20]. Although standardized tests are not the only true indicator of a student’s ability to study engineering [21] (NACME has developed more authentic criteria for its Vanguard program, as have other programs [22-26]), Ohio Colleges of Engineering (CoEs) use the ACT math score as the threshold for admissions. Considering this fact, only the above 163 students could be considered for admission to the 13 CoEs in Ohio universities, and assuming that these students applied for engineering, with equal distribution, this results in 13 applicants per CoE. This is important at the University of Cincinnati (UC) because 96.4% of CoE students are from Ohio. Nationally, African Americans make up 12.1% of the U.S. population, 11.6% of college students, and 6.3% of engineering undergraduates. As a result, they constitute only 2.7% of U.S. engineers [27, 28]. At UC, African Americans comprise 3.92% of engineering undergraduates.

Our engineering schools now face internal and external challenges, impacting the marketability of our students. With improved telecommunications and the digitization of work, more engineering can be done without close proximity to particular persons, places, or other processes [29]. Off-shoring is likely to have little impact on the most highly educated and brilliant
engineers since there will always be positions for them. Thus, engineering education will also be changing, with more emphasis on graduate education, as outlined in a recently released series of reports by the National Academy of Engineering [30]. Educators recognize that undergraduate research motivates students to apply for graduate school, and underrepresented groups must become an integral part of such a technical workforce. However, underrepresented college students do not reflect their numbers in the U.S. population (51% women, 12.1% African Americans, and 12.5% Hispanics [27, 28, 31]). A recent National Academies report [32] recommends: “Increasing participation of underrepresented minorities is critical to ensuring a high quality supply of scientists and engineers in the U.S. over the long-term.” Research shows that women and minorities may exit the pipeline early because of lack of financial resources, information about various career paths, and faculty mentorship and encouragement [33]. Companies hire ethnic candidates not only because of government regulations but also because of the growing diversity of their client bases. In short, having a diverse workforce is now an essential part of doing business [34]. The Congressional Commission on the Advancement of Women and Minorities in Science, Engineering, and Technology Development also notes it no longer is appropriate to consider under-representation as merely a social problem or a moral imperative [35]. Rather, it is now an economic problem and a national imperative.

To help understand our regional challenges, we used NSF Bridges to Engineering (BEE) Planning Grant (# 0230535), Project SMART, to conduct 7 Cincinnati-area focus groups with 11 professionals and 39 K-12 administrators and teachers to identify ways to increase engineering enrollment. Meetings identified causes and solutions for declining engineering enrollment. Then, surveys in spring 2003 investigated the lack of engineering understanding among students. Of 4,263 Grade 6-12 students from 14 school districts, 28% were interested in engineering, and in particular, 12% of females and 33% of ethnic students were interested in engineering [36]. (However 5% of high school graduates applied for engineering, and 1% of engineering undergraduates come from underrepresented ethnic groups.) To understand why UC College of Engineering students chose engineering and what is needed for retention, we sent surveys to undergraduates in all majors and years. Of the 620 responses, many chose engineering because of their interaction with an engineer, exposure from teacher presentations, and the potential for a stable income. These students cite UC’s Co-Op program (ranked among America’s top-ten elite by US News & World Report [37]), location, cost, and reputation as reasons for studying at UC. In terms of retention, more female students and less ethnic students (vs. males and non-ethnic students, respectively) considered leaving UC. Also, slightly more females and slightly less ethnic students changed majors.

This paper describes the successful recruitment strategy implemented to recruit 36 S-STEM Scholars who started in fall of 2007, the strategies and programs implemented to assist in their academic success through graduation, and a plan for recruiting the students to graduate school. The University of Cincinnati Evaluation Services Center conducted the evaluation of the scholarship program’s implementation.

**Goals and Objectives**

Our goal was to increase and retain to completion the number of women and underrepresented ethnic students in the fields of Engineering and Computer Science in the College of Engineering
(CoE) at the University of Cincinnati (UC), and to create the best financial and academic support environment for studying and performing research so that they become well prepared for graduate education and the rigors of the ever-changing global market.

The objectives of the project are: (1) In five years, the recruitment of women (non-ethnic and ethnic) engineering students will be increased from 16% to 21% of the freshmen students relative to the fall 2005 enrollment. (2) In five years, the recruitment of ethnic (women and men) engineering students will be increased from 5% to 10% of the freshmen students relative to the fall 2005 enrollment. (3) In five years, graduate 74% of the students from these targeted populations relative to spring 2005. (4) Having the above enrollment of underrepresented ethnic engineering students in the UC’s CoE would bring us into parity with the number this group represents in the State of Ohio. (5) Upon graduation, place 100% of these targeted students in technical jobs or graduate school. (6) Develop a pathway program that prepares 33% of the S-STEM Scholars to compete for graduate school admission and financial support and succeed in graduate school.

**Recruitment Plan**

The first step in the recruitment plan was to seek qualified prospective students. This was accomplished by using the university’s Connect email system, a marketing software system used to communicate with prospective students. The University purchases student names and demographic data through SAT and ACT data banks. With the use of Connect, 6,885 female and ethnic students were sent information about the College and the S-STEM scholarship opportunity. Via regular mail, 3,615 female and ethnic students were sent a cover letter and the S-STEM flyer, which is presented as Figure 1 on next page. These two initiatives resulted in 25 applications for admission.

The College also attended several college fairs and visited high school math and science classrooms, targeting underrepresented ethnic and women students. These activities included 40 college fairs and 35 high schools. These activities resulted in 1,175 prospective students added to our database for fall 2007 including 245 (20.7%) majority females, 177 (15%) underrepresented males, and 71 (6%) underrepresented females. To encourage women and underrepresented students to visit the University, prospective students received certificates for reimbursement of travel expenses up to $300 for the Midwest area and $600 for the east and west coast areas.

Other recruitment activities included a Woman in Engineering Open House, where 18 prospective students attended with their parents. Also, the S-STEM Scholarship letter and flyer were sent to 1,030 high school principals and 34 JETS (Junior Engineering Technical Society) coaches. The College hosts the largest JETS TEAMS competition in the nation and has built strong relationships with the high school math and science teachers (coaches). The 2007 JETS competition included 41% women. Another point of contact included a Happy Holiday letter that was sent to 170 prospective females and 62 ethnic males.

Prospective female and underrepresented ethnic students who visited campus experienced a full day that included a University presentation and a full campus tour, followed by lunch with the
S-STEM Scholarship Program

- Assurance that in-state tuition is met in a UC scholarship award package—a value of more than $37,000 over five years!

- Renewable for 12 in-class quarters

- 32 incoming freshmen to be awarded

Qualifications & Renewability

- Open to U.S. women or U.S. students of color (African American, Hispanic, and American Indian men and women) who are not eligible for tuition remission

- Complete UC admission application (including transcript and test scores) must be received by January 15th for scholarship consideration

- Student must have 3.0 minimum unweighted high school GPA (4.0 scale) and one of the following: 23 ACT or 1070 SAT

- Renewability based on full-time enrollment in the College of Engineering and individual academic requirements of awarded funds

For information on this scholarship program, academic programs, and the admission process, contact:
UC College of Engineering
engineering.preadmissions@uc.edu
513-556-5417
www.eng.uc.edu

Figure 1. Flyer Used For Recruitment
College of Engineering. This was a collaborative effort with the College’s Admissions Office, the Rowe Center, and the College’s Emerging Ethnic Engineers (E³) Office. Student ambassadors from the E³ program, NSBE, and SWE also participated. The prospective families spent the afternoon at the College, meeting faculty and touring the laboratories.

Table 1 shows admission information for majority women and underrepresented students. The College of Engineering had a total of 1,678 undergraduate applications, 1,192 offers of admission, 717 confirmations, and 655 enrolled students. All data given in this chart includes domestic students only (no international students).

Table 1. Total Students Recruited in the College of Engineering During 2006-2007

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Applications</th>
<th>Offered Admission</th>
<th>Confirmed Admission</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majority Female</td>
<td>225</td>
<td>137</td>
<td>95</td>
<td>92</td>
</tr>
<tr>
<td>Ethnic Female</td>
<td>36</td>
<td>23</td>
<td>15</td>
<td>14</td>
</tr>
<tr>
<td>Ethnic Male</td>
<td>170</td>
<td>65</td>
<td>38</td>
<td>35</td>
</tr>
<tr>
<td>Total</td>
<td>431</td>
<td>225</td>
<td>148</td>
<td>141</td>
</tr>
</tbody>
</table>

Table 2 shows the number of S-STEM scholarship offers and the number of scholarship acceptances and students enrolled for fall 2007.

Table 2. Students Recruited in the College of Engineering for the S-STEM Scholarship During 2006-2007

<table>
<thead>
<tr>
<th>Demographic</th>
<th>Offered</th>
<th>Accepted</th>
<th>Enrolled</th>
</tr>
</thead>
<tbody>
<tr>
<td>Majority Female</td>
<td>37</td>
<td>17</td>
<td>17</td>
</tr>
<tr>
<td>Ethnic Female</td>
<td>9</td>
<td>7</td>
<td>7</td>
</tr>
<tr>
<td>Ethnic Male</td>
<td>27</td>
<td>12</td>
<td>12</td>
</tr>
<tr>
<td>Total</td>
<td>73</td>
<td>36</td>
<td>36</td>
</tr>
</tbody>
</table>

The UC’s engineering undergraduate program is a mandatory five-year program, which includes six quarters of required paid co-operative (co-op) experience. The college is formally organized into six academic departments which offer eight undergraduate degree engineering programs (Aerospace, Biomedical, Civil, Chemical, Computer, Electrical, Materials, and Mechanical) and an undergraduate Computer Science degree program. The College has two established programs to increase the number of targeted students. The first program, Freshman Engineering Program (FEP), admits incoming freshmen with lower ACT or SAT scores with the stipulation that they can select the engineering discipline of their choice at the end of their freshman year if they earn a 2.5 or higher GPA. It allows students who do not traditionally perform well on standardized tests to be admitted. The second program, the ACCEND (ACCelerated ENgineering Degree) Program, is a combined 5-year BS and MS degree program with co-op and research experiences integrated with education.

The UC’s College of Engineering’s BS program admission criteria was used in selecting the candidates, which includes the following requirements: high school coursework including 4 units of college prep Math, 1 unit of Chemistry, and 1 unit of Physics; for Biomedical and Aerospace 26 ACT/1170 SAT or a rank of top 10%; and for all others 24Math/24Composite in ACT or 560 Math/1110 Composite in SAT or a rank of top 10%. The use of “or a rank of top 10%” provides
access to high achievers who do not test well. Admission requirements for FEP (see previous page for definition) are 22Math/22Composite in ACT or 520Math/1030Composite in SAT or 21ACT/990SAT and top 65% rank and a 2.5 GPA. Upon enrollment, students follow a curriculum of their choice. Upon freshman year completion and a college GPA of 2.5, the FEP student may matriculate into their choice of BS program.

Table 3 on next page presents the demographic information of the S-STEM Scholars selected. Of the 35 enrolled students, 8 are out of state students. These students have traditionally been very difficult to attract due to the limited pool of underrepresented ethnic students and the lack of a competitive scholarship to attract them. The University’s out of state tuition and fees are $23,922, a barrier for most students. For fall 2007, the University approved a $9,100/year out of state scholarship for the College of Engineering, limited to 42 awards. The College of Engineering was able to combine the $9,100/year out of state scholarship with the $9,399 S-STEM scholarship for out of state women and underrepresented ethnic students, totaling $18,499/year.

Strategies for Academic Achievement, Support, and Success

Ten out of the nineteen underrepresented ethnic S-STEM Scholars participated in the Emerging Ethnic Engineers (E³) Summer Bridge Program (19th year), a seven-week residential program for incoming underrepresented ethnic engineering freshman. A total of 33 underrepresented ethnic students participated in the 2007 Summer Bridge program held in the College of Engineering from June 25 – August 10, 2007. Before starting the program an orientation was held on August 24 in which all the students and their parents/guardians participated.

The objective of the program is to create a “learning community” of E³ students who develop the academic and social skills necessary for achieving academic excellence from freshman year through graduation. This process begins with the structure of the courses (Pre- Calculus, Calculus, Chemistry, English, Introduction to Physics, and Physics), taken during the program. All instructors use Collaborative Learning, an instructional method that requires students to interact on a higher level than in a traditional classroom setting. It involves learning methods and techniques using Cooperative Task Structures in which students spend time working in 4 to 6 member heterogeneous groups. Students are required to work collectively toward the common goal of mastering the course material.

Summer bridge students have an opportunity to understand the relevance of their course work through visits to area companies. This year’s visits were to Procter and Gamble, General Electric Aircraft Engines, and the Toyota Motor Engineering and Manufacturing North America, Inc. headquarters in Erlanger, Kentucky. They also visited Toyota’s Georgetown, Kentucky manufacturing plant, which produces the Avalon, Camry, Camry Hybrid, and the Solara vehicles. The visit to General Electric was hosted by six former E³ students who reinforced the importance of the Summer Bridge Program.

During the last week of the program students complete their final exams and attend an exit interview for each course. All students are required to prepare a written assessment of their
Table 3. 2006-2007 Student Demographic Data

(M = Male; F = Female; WC = White Caucasian; AA = African American; HS = Hispanic)

<table>
<thead>
<tr>
<th>State</th>
<th>Gender</th>
<th>Race</th>
<th>GPA</th>
<th>Rank</th>
<th>ACT</th>
<th>SAT</th>
<th>Degree Program</th>
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<td>M</td>
<td>AA</td>
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<td>27</td>
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</tr>
<tr>
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<td>M</td>
<td>AA</td>
<td>2.903</td>
<td>45.333</td>
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<td></td>
<td>Mechanical Engineering</td>
</tr>
<tr>
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<td>F</td>
<td>WC</td>
<td>4.02</td>
<td>9.615</td>
<td>31</td>
<td>1350</td>
<td>Mechanical Engineering-ACCEND</td>
</tr>
</tbody>
</table>

performance, and they receive a written assessment from each instructor. The objective of the assessments and exit interview is to give students specific information as it relates to the academic and social development. In an effort to have the students use the information from the assessments and exit interviews, all instructors prepare homework for students to complete and turn in on weekly basis up to the start of fall quarter.

The process of building the E³ learning community is initiated with the Summer Bridge Program and is fully implemented through the E³ Learning Community courses, in which the students register in the fall, (at the university’s orientation during the Summer Bridge Program) winter, and spring quarter of their first year.
The academic year 2007-2008 at University of Cincinnati (UC) started on Wednesday, September 19, 2007. All S-STEM scholarship recipients participated in the standard welcome and orientation functions organized at the university and college levels during the week before the start of the school year and during September 19 to 23. The S-STEM attended a welcome dinner and orientation on September 24, 2008 as shown in Figure 2. The goals, objectives, activities planned, and expectation of the program will be presented to the students. Specifically, a one-page document, presented as Figure 3 on next page, was given to the students summarizing the program goals, objectives, expectations, and the actions if the expectations are not met.

![Figure 2. S-STEM Students at Welcome Dinner](image)

**Academic Assessment and Monitoring.**

S-STEM coordinators facilitated the academic assessment and monitoring for the S-STEM student’s matriculation in the college. Students met with them once every quarter to discuss the previous academic quarter. Each student was required to turn in a minimum of three progress reports from faculty for each course taken. The progress report form shown in Figure 4 was used to monitor each student’s academic progress. The progress reports are used as an assessment tool, allowing students to receive feedback from their instructors. This allows students to make the necessary adjustments with regard to their academic performance in their courses. The S-STEM Coordinators filled out a Student Consultation Form during each quarterly meeting, which contained responses to the following: (1) has student met with her/his instructor(s); (2) has student met with her/his advisor? (3) issues/topics, and (4) recommendation(s). The coordinators and the student agree on recommendations to enhance their academic or professional development, the student receives a signed copy of the form.

Each student was required to maintain a 2.75 cumulative grade point average. S-STEM Scholars, who did not meet the grade point average requirement, had one quarter to raise their cumulative grade point average to 2.75. During the above meeting students whose cumulative grade point average was lower than 2.75 were cautioned about the repercussions and were asked to present a strategy to overcome this problem in the following quarter. If the student failed to
Congratulations on your admission to the College of Engineering and your selection as an S-STEM Scholar. The objective of the scholarship is to increase the number of women and underrepresented ethnic engineers students who enroll and graduate from the college. We have developed an academic success and support strategy to assist you in retaining your scholarship.

**REQUIRED ACTIVITIES AND EXPECTATIONS**

S-STEM Scholars are required to implement the following academic support activities from their freshman through senior year:

1. Quarterly meeting with S-STEM faculty mentor group to discuss academic progress.
2. Quarterly meeting with PI and/or Co-PI(s) of the grant to discuss academic, social progress, and/or co-op experience.
3. Enroll in departmental specific Introduction to Engineering course.
4. Compete three Progress Reports per course for each academic quarter.
5. Enroll in College of Engineering Learning Community courses freshman year.
6. Attend monthly social gathering for S-STEM Scholars.
7. Maintain a 2.75 cumulative grade point average.

S-STEM students, who do not meet the grade point average requirement, will have one quarter to raise their cumulative grade point average to 2.75. If the student fails to do this, a meeting should be scheduled with, at minimum, two of the grant administrators. A decision will be made at that time to either terminate the S-STEM Scholarship, or continue the S-STEM Scholarship for one more quarter. If the student fails again to raise his/her grade point average, the S-STEM Scholarship will be terminated with no appeal possible.

I have read and I understand that I must meet all of the requirements and expectations for the renewal of your scholarship.

____________________________________  ______________________
Name        Date

*Figure 3. Objectives and Expectations from S-STEM Scholarship Recipients*
TO: Professor:                                      Date: _________

RE: Student: ________________________ Year/Quarter: 2007 / ________

Class: ________________________________

Course No.: ____________________________     Current Grade: ______

Week No.: ______________________________

S-STEM STUDENT SHOULD MAKE A COPY FOR THEIR FILES AND BRING THE ORIGINAL TO DR. KUKRETI, MS. BURDICK OR MR. SIMONSON.

Please evaluate this student in terms of:

Very Good   Good   Fair   Poor   Very Poor   N/A
  1        2       3       4       5          6

1. Attendance __________________
2. Assignments/projects on time __________________
3. Quality of Homework ____________
4. Quiz performance ______________
5. Test performance ______________
6. Class/project participation ____________

Has the student met with you during office hours or any other time to discuss her/his academic progress?
Yes ___    No ___

Please offer any other suggestions that would assist the student in succeeding in your class.

_________________________________________________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________________________________________________
_________________________________________________________________________________________________________________________________________________________________________

Instructor Signature              Date

Figure 4. Academic Progress Report
increase the cumulative grade point average to 2.75, a meeting was scheduled with, at minimum, two of the grant administrators. A decision was made at that time to either terminate the S-STEM Scholarship, or continue the S-STEM Scholarship for one more quarter. If the student failed again to raise his/her grade point average, the S-STEM Scholarship was terminated with no appeal possible.

**Supplemental Cooperative Learning Classes**

Following the Bridge Program all E^3 S-STEM students participated in Math/Science Learning Community Courses. Other S-STEM students were encouraged to enroll, but it was not mandatory. These courses are first and second years Cooperative Learning courses in Pre-Calculus 250, Calculus 251, 252, 253, and 264 (sophomore year); and Physics 201 and 202. These courses are one-hour credit courses and the students meet twice a week for two hours with a dedicated instructor for the course. This instructional methodology requires students to interact in groups of 3 to 4 students to master the course material. We include following five essential components that enable truly Cooperative Learning: (1) Develop positive interdependence so students cannot succeed unless their group mates do (and vice versa). (2) Facilitate face-to-face interaction so students are aware of each other’s learning processes. (3) Promote accountability by evaluating individual performance and sharing the results with the group. Then, groups will know who needs more support and encouragement, and students cannot “piggy-back” on the work of others. (4) Encourage development of interpersonal and small group skills by discussing and promoting the social skills required for high quality collaboration. (5) Organize reflection on group performance so students focus on improving effectiveness of group work.

Cooperative Learning’s technical merits include: (1) Group study combined with individual study has proven to be more effective and fun than studying alone. (2) Much of our learning occurs through dialogue. Conversation enhances one’s ability to relate new concepts and ideas to existing personal knowledge, and Cooperative Learning fosters this kind of interaction. Cooperative Learning’s broader impacts include: (1) Students develop collaboration skills that they can use for a lifetime. (2) There is a reduction in tutoring expenses since students begin relying on each other for learning assistance. (3) Students experiencing academic difficulties are identified earlier, so their peers can help them promptly.

**Supplemental Mentoring Opportunities for Women**

All women students had access to Peer Mentoring: University of Cincinnati’s College of Engineering student government group organizes a “Big Brother/Big Sister” program that matches incoming freshmen with upperclassmen, ideally in their major. It provides social and academic benefits to students by building a sense of community – a key factor in retention. Mentoring occurs via phone, e-mail, and meetings. In addition, social, athletic, and cultural events for all program participants are held throughout the year.

Women engineering upperclassmen who receive a “B” or higher in key subjects are invited to receive academic credit for volunteer work by becoming Peer Leaders in the University of Cincinnati’s Learning Communities for first year students. As stated earlier, all first year
engineering students are in a learning community. By accepting this honor, they enhance their leadership skills by organizing study sessions and serving as role models for lowerclassmen. Also, through teaching, they further strengthen their own academic proficiency.

The technical merits of this program include: increased interaction between first year and upper-class women students through peer mentoring, thus, providing the social support needed to make the transition from high school to college; and on-going mentoring provides career support and advice for balancing one’s personal life. Together, these activities support students from college start to career development, so students develop better self-confidence and are more likely to stay in engineering. As the highest attrition of female students occurs in the first two years, this project creates automatic participation in effective programs at a time when students need support the most. The broader impacts of this program include: Retention of underclassmen; Upperclassmen can reinforce their engineering background through tutoring and mentoring, and Underclassmen can improve their self-esteem and sense of community.

Monthly Socials

Monthly socials are held for the S-STEM Scholars. Each social has an invited speaker, and table seating is based on disciplines so students at different academic stages can interact and discuss issues such as courses, curriculum, and student life. Monthly Socials’ technical merits include: (1) students share information regarding academic scheduling, books, test files, etc.; and (2) interaction between students and faculty has proven to improve retention. Broader impacts include: (1) long-term friendships can be established that are valuable throughout the students’ careers; and (2) advice and information acquired by students from mentors can be broadly disseminated.

Cooperative Education Program

Celebrating its 100th year, UC’s Co-Op program is the nation’s largest mandatory Co-Op program, managed by the UC’s Division of Professional Practice. Undergraduate programs span five academic years to allow from 4 to 6 required Co-Op quarters. All S-STEM participants will work in paid Co-Op jobs for 6 quarters during the sophomore, pre-junior, and junior years (they will not Co-Op during freshmen and senior years). Working with UC’s Institute for Global Affairs, the College of Engineering has also established an International Co-Op Program to provide students the opportunity to work abroad after sufficient language and culture preparation. Students earn between $38,000 and $58,000 from Co-Op employers, part of which can be used to pay for remaining four years of study. UC College of Engineering Co-Op facts include: Required by all 9 majors; 2,004 undergraduates in fall 2007; Male/female: 84%/16%; Admission guidelines: Average SAT=1230; Average ACT=26; Full-time/part-time faculty: 141/21; and Average class size: 22; and student/faculty ratio: 14:1.

With assistance from the faculty advisors in the Division of Professional Practice, during the sophomore to junior years, mentorship will be provided to the students to guide them to appropriate Co-Op jobs to suit their career. The technical merits of this program include: (1) it fosters an early discussion on academic performance, time-on-task, and skills necessary for successful Co-Op experiences. (2) It assists in the freshmen and sophomore year transition by
making sure that students participate in all S-STEM academic and professional support strategies. (3) It provides an opportunity to communicate the relevance of early course materials to future courses and their impact. The broader impacts of this program include: (1) It helps students understand the relationship between academic and social development for earning their engineering degree. (2) It provides early access for industry employers who seek to recruit a diverse Co-Op and career workforce.

The S-STEM Scholars were encouraged to perform voluntary service, preferably as an outreach K-12 activity. Some of the S-STEM Scholars are also recipients of the UC Cincinnatus Scholarship, which also requires them to provide 30 hours of volunteer service. The S-STEM Scholars were asked to document their experience and also provide input on the type of service learning experience they would like to do, if any, during next year. The verbatim open-ended survey responses from the evaluation are presented in Table 4 on next three pages.

S-STEM Scholar Program Evaluation

The Evaluation Services Center, University of Cincinnati (UCESC) conducted the program evaluation for the S-STEM Scholar program. This evaluation consisted of a hardcopy survey and facilitated group discussions for 24, 2008 S-STEM Scholar participants. It was conducted on May 15, 2008, at the end of their freshman year. The students completed the surveys and then were randomly assigned to four groups where they responded to additional questions. Their responses were recorded on flip charts and reported to the total group by one group member.

The survey results are compiled in Table 5. Survey assessed the participants’ on the structure of the program, benefits of the program and reasons for their participation. Below are salient results from the survey:

- The results showed that students strongly valued the diversity of race and gender in the S-STEM program. They felt comfortable in participating in the monthly meetings. When asked if they would prefer single race and single sex S-STEM Scholar meetings, 95% of the students did not prefer single race and 83% did not prefer single sex meetings.
- Students (65%) stated that they would participate in Volunteer Service hours during the next school year.
- Students (66.7%) reported that the Engineering Faculty were very helpful.
- When asked if receiving the S-STEM Scholarship was the major reason they selected the University of Cincinnati, the student response was very mixed (25% strongly agreed, 33% agreed, 33% disagreed). The open-ended responses to why they selected the University of Cincinnati identified three main reasons: (1) “Close to home,” (2) The amount of the scholarship offered/money, and (3) The quality and reputation of the engineering program.
- The benefit of the S-STEM program to the students was not easily deduced by the students’ scaled survey responses. Fifty percent of the students gave a neutral response when asked if their academic performance was improved because of participation in the S-STEM Scholar program and 70% gave a neutral response when asked if the program helped them to transition socially from high school to college this year. The students identified the career discussion in the meeting by the women engineers as the most beneficial to them when asked in an open-ended question.
### Table 4. Service Learning Activity Done or Preference to Do if Provided

<table>
<thead>
<tr>
<th>Activity Done or Would Like To Do</th>
</tr>
</thead>
<tbody>
<tr>
<td>&quot;The type of community service I would like to do is tutor elementary school children, help out with after school programs, or help out at the Ronald McDonald House.&quot;</td>
</tr>
<tr>
<td>&quot;First off, Cincinnatus scholars are required to have 10 service hours per quarter, making 30 for the year for most of us (not the quarter!). Secondly, my service has included volunteering for the Hoxworth Center at the blood drives, ushering at The Know Theatre, helping with the annual mulch sale for Boy Scouts, and doing community service through my church. I’ve had some interest in helping with schools in the area; however they must be within walking distance or provide transportation seeing as I don’t have a car on campus and I’m not familiar enough with the bus system to be comfortable relying on them.&quot;</td>
</tr>
<tr>
<td>&quot;The service hours I participated in were for Metro Mission. I did a total of about 8 hours where I put in floor boards at a house and cleaned the house.&quot;</td>
</tr>
<tr>
<td>&quot;My idea for an outreach program comes from one I participated in a few weeks ago. SWE had a blood and guts experiment and the children got to practice Engineering by performing a certain task. A small field trip also happened. The children got to visit a lab here on campus and see the applications of engineering. I found it particularly interesting to see so many young faces excited to learn about Engineering.&quot;</td>
</tr>
<tr>
<td>&quot;I’m sorry, but I have my service hours under control for my Cincinnatus Scholarship. I have served with Habitat for Humanity and Hoxworth blood drive.\nI have already done some community service: helped with hall opening for winter and spring quarter for Daniels hall and worked for the Cincinnatus Scholarship.&quot;</td>
</tr>
<tr>
<td>&quot;Serve Beyond Cincinnati (SBC) – Building wall units for homes to be built in Alabama (Habitat for Humanity).\nHabitat for Humanity – Building a house on 3470 Haven Street, Cincinnati, Ohio. (My main task was painting).\nThe Navigators- Renovating homes so families can move into a safer environment.&quot;</td>
</tr>
<tr>
<td>&quot;This past year I have participated in more community service than I had actually reported. To start off, I participated in the Into the Streets program where I helped paint and rearrange furniture in the basement of a daycare center. I have donated blood at the Hoxworth Campus Blood Drive. I have participated in the Relay for Life with the Student Body of Christ organization. I helped plant flowers at the corner of Vine and Martin Luther King Street. I had went to the Ronald McDonald House with the Society of Women Engineers where we fixed the families living there grilled cheese sandwiches and tomato soup for lunch. Finally, I helped assist prospective students to the proper destinations during the Cincinnatus competition.&quot;</td>
</tr>
<tr>
<td>&quot;My service hours were I volunteered for SWE Middle School Outreach Program for 10 hrs ushers at CCM for 10 hrs, volunteered at the butterfly show for 4 hours helped at Operation Warm-up for 3 hrs, and planted trees for Clifton Clean Up for 3 hours.”</td>
</tr>
<tr>
<td>&quot;Did not do any volunteer service hours; I thought it was for Cincinnatus Scholars only.”</td>
</tr>
<tr>
<td>&quot;My volunteer service included:\n1. University of Michigan Flint Educational Opportunity Initiatives Office: April 12 - 3 hours.\n2. YMCA of Flint Memorial Day Fun Program: May 24 - 5 hours\n3. YMCA of Flint Summer Adventures Program: June 16- June 20 - 30 hours total (6 hours a day).\n4. Neighborhood Clean-Up: July 12 - 2 hours.”</td>
</tr>
<tr>
<td>&quot;Maybe some kind of simple building project, which maybe a bridge or a building project.”</td>
</tr>
<tr>
<td>&quot;I am one of the S-STEM Scholarship recipients and I attend the monthly socials. I was unaware of the urgent volunteer information that was needed as I am not a Cincinnatus scholarship recipient and have no volunteer hours. I did not know that volunteer hours were required for S-STEM. I am willing to...&quot;</td>
</tr>
</tbody>
</table>
volunteer for anything that comes up. Please let know how or when I can help out. Thanks!”

“For my community service hours I have spent time volunteering at a nursing home and I also volunteered at the Cincinnatus competition.”

“I think that it would be a great idea if we went to the elementary schools and read to them. I did a program like this at my elementary school and the students loved that older students were taking the time to come see them and spent time reading with them. They also were so proud that they got to show off their reading skills and picked their favorite books to share.”

I want to tutor fifth graders at St. Aloysius Gonzaga (Bridgetown).

“(1) UC Habitat House - 7 hours.
(2) Hoxworth Blood Drive (on-campus).
(3) 1 hour Volunteer to help with mailing of Northwest Local School District Newsletter.
(4) 5 hours Relay for Life (UC).
(5) 9 hours Volunteer to assist with sound management every Sunday church service at White Oak Presbyterian Church,
Performed a total of 12 hours.”

“At Taft Elementary, I participated in an after school program during fall quarter that was focused on tutoring as well as other activities. I am not sure if the program is still going on, but it seemed beneficial when I was involved in it. Again, I am sorry for sending this late. I will be at the meeting at 5.”

“I would like to tutor middle school or high school students in math.”

“Into the Streets/Beautification of the Cincinnati Area (8 hrs.).
Packed Halloween Candy Bags for Ronald McDonald House (1 hr).
Serving food at a dance competition for non-profit organization (8 hrs.).
Relay For Life Team Captain (13+ hours).
Total of Thirty hours.”

“I have done about half of my 30 hours of Cincinnatus for the year so far, I don’t know what the best way to present the things I have done so far in the best and most organized manner. But here is what I have done so far:
Cincinnatus 11: 8 hours of guiding students to testing areas and question and answer sessions.
Operation Warm-up: 3 hours helped the UC Hillel for this event by making posters to advertise the event.
Making Valentines cards for Kids with Cancer: 1 hour.
Ushering for CCM performance: 3 hours.
I have plans to usher again in may and I have planned to do "Green-up day" in burnet Woods on May 3rd.
As for other things I would like to do: I would have liked to have tutored younger kids in science and math but I didn't have the time or transportation to get to anywhere, or I would love to do an outreach to middle school girls to tell them about engineering.”

“Here are my community service hours I have done so far:
10/6/07, 6 hours - My roommate and I volunteered for the Kids First Halloween Spooktacular carnival for kids. We were in charge of looking after kids on a giant inflatable slide as well as a Moon Bounce. We also helped with the overall set up and clean up of the entire event.
2/16/08, 7 hours - I volunteered to help out with the Cincinnatus competition and was in charge of taking groups of students from building to building and answering any questions that the students and parents had.
On assorted dates a group of friends and I have gone to the St. Francis Soup Kitchen and help serve dinner. We have done this on multiple occasions.
I am also on a Relay for Life team, which will be another 9 hours.”

I have volunteered for the:
Serve Beyond UC organization picking up trash,
SWE helping female elementary and middle schoolers build biomedical equipment out of household
items, and  
I volunteered for the Obama campaign when they came to UC.”  
“I am participating in a volunteer activity at Taft Elementary School where a group of UC students  
comes up with educational activities to do with Taft Students after school program.”  
“St. John’s “Share-A-Lunch” I made sandwiches and helped pack lunches for a soup kitchen that feeds  
the homeless and economically disadvantaged. Hours: 3.  
Tyler’s Creek “Homework Club” I helped 1st - 6th graders with their homework. These children are  
UC Biomedical Learning Community I helped put together Halloween candy bags for the children and  
families at Ronald McDonald House. Hours: 1.  
“Green-Up Day 2008” I am going to help clean up and revitalize Burnett Woods. Tasks include  
removing honeysuckle, painting picnic tables, spreading wood chips, and other various tasks. Hours: 4.”  
“My volunteer service entailed working at Clifton Cleanup, Burnett Woods (pulling weeds), CCM  
performances, Butterfly show and Cincinnatus Competition.”  
“I have performed a recorded amount of 15 hours in community service in the past academic year. I  
participated in my friend’s relay for life group, “The Rowdy Rodeo,” at Rocky River High School where  
I helped raise money, totaling $254.10, for 5 hours. Then I also help a minimum of 10 hours at the  
Cleveland Air Show as a concession stand volunteer.”  
“For my service hours I volunteered at the Cincinnatus Competition, at the Engineering Expo/Science  
Fair, at a Girl Scouts Day Camp, and at a Kids Fair.”  
“Being a Cincinnatus scholar, I have completed quite a handful of tiresome hours in service to the  
Cincinnati community and beyond. The first ten service hours were devoted to cleaning up of UC  
surroundings. I am proud to say the rest twenty hours of community service were devoted to collecting  
college textbooks for students in Africa. The goal was to acquire not more than a hundred books. Last  
time I checked, we were standing at 1000 college textbooks, each worth $150 on the average. I would  
say I have served my immediate community and those in need very well.”  
“Previously I’ve volunteered with Special Olympics and adapted baseball. Adapted baseball is baseball  
for kids with disabilities. I’ve also volunteered after school at the LeBlond boys and girls club in Over-  
The-Rhine. I was also a mentor for Beech Acres; we had one planned social activity a month and were  
required to make weekly contact. I’ve made cards for kids in hospitals and worked at food pantries. I’d  
like to do service that doesn’t take a lot of time but still has an effect. Because I’m so busy right now I  
think making cards or goody bags for an organization would be best.”  
“During my volunteer time I helped tutor freshmen and sophomores in any subject the student needed  
help in. For most of the day I would sit in a study hall room, and the student would leave their study hall  
room and come to my room for any help. I also made a few classrooms stops for extra help.”  
“Sorry, I just haven’t had many ideas. For Cincinnatus, I volunteered with Nightwalk and worked at a  
soup kitchen. Other good ideas are volunteering at a food bank, or going to schools to educate students  
about engineering and the sciences.”  
“Volunteer Hours:  
ADVANCE Scavenger Hunt: It was a scavenger hunt held by ADVANCE in Downtown Cincinnati. I  
passed out clues to the participants. It was about 4 hours.  
Clean-Up: I participated in cleaning up around the university and the Clifton area. It was about 4 hours.  
Cincinnatus Scholarship Competition: I served as a helper for the 2008 Cincinnatus competition. It was  
about 8 hours.  
Obama Campaign: When Barack Obama came to the university, I helped in the campaign by getting  
people to sign up for various things needed from the campaign group. That lasted about 2 hours.”
| The major reason I selected the University of Cincinnati was because I received the S-STEM Scholarships. | 3.50 | 6 (25.0%) | 8 (33.3%) | 2 (8.3%) | 8 (33.3%) | 0 |
| My participation in S-STEM Scholar activities improved my academic performance this school year. | 3.37 | 1 (4.2%) | 9 (37.5%) | 12 (50.0%) | 2 (8.3%) | 0 |
| My involvement in the S-STEM Scholar program helped me transition socially from high school to college this year. | 3.16 | 1 (4.2%) | 4 (16.7%) | 17 (70.8%) | 2 (8.3%) | 0 |
| I am more confident in my ability to succeed in Engineering because of my participation in the S-STEM Scholar program. | 3.46 | 0 | 12 (50.0%) | 11 (45.8%) | 1 (4.2%) | 0 |
| The quarterly meetings with my advisor (Simonson, Kukreti, and Johnson) were very helpful. | 3.37 | 2 (8.3%) | 11 (45.8%) | 5 (20.8%) | 6 (25.0%) | 0 |
| The monthly meetings/socials were very informative. | 3.46 | 0 | 13 (54.2%) | 9 (37.5%) | 2 (8.3%) | 0 |
| I felt comfortable participating in monthly meetings/social activities. | 4.04 | 7 (29.2%) | 11 (45.8%) | 6 (25%) | 0 | 0 |
| I would prefer single sex S-STEM Scholar meetings. | 1.71 | 0 | 1 (4.2%) | 3 (12.5%) | 8 (33.3%) | 12 |
| I would prefer single race S-STEM Scholar meetings. | 1.37 | 0 | 0 | 1 (4.2%) | 7 (29.2%) | 16 |
| The required monthly progress reports facilitated a positive relationship with my teachers. | 3.04 | 0 | 8 (33.3%) | 10 (41.7%) | 5 (20.8%) | 1 |
| The Engineering Faculty was very helpful. | 3.79 | 4 (16.7%) | 12 (50.0%) | 7 (29.2%) | 1 (4.2%) | 0 |
| The required monthly progress reports from teachers were academically helpful. | 3.29 | 2 (8.3%) | 8 (33.3%) | 10 (41.7%) | 3 (12.5%) | 1 |
| I was uncomfortable obtaining monthly progress reports from teachers. | 2.54 | 0 | 5 (20.8%) | 6 (25.0%) | 10 (41.7%) | 3 |
| I would take a Community Learning Class if offered during my sophomore year. | 2.75 | 4 (16.7%) | 2 (8.3%) | 6 (25.0%) | 8 (33.3%) | 4 |
| I would participate in Volunteer Service hours during the next school year. | 4.21 | 4 (16.7%) | 11 (45.8%) | 4 (16.7%) | 0 | 0 |
Balancing the demands of classes and social life was identified as a challenge for the students. This resulted in time management issues for them. Many students reported difficulty learning how to study effectively for the more difficult classes (Physic, Calculus, and Chemistry).

As part of the group discussions, students identified their biggest challenges faced during their first year, the benefits of the S-STEM program and made suggestions for areas of improvement for the S-STEM Program.

Physics was identified as a problem in much of the discussion with the students. The students found it to be one of their biggest challenges and actively discussed it within their groups. They were dissatisfied with the quality of the teaching, the timing of the class, and the time of the labs. Effectively managing their time was also identified as a challenge for the students.

Four Benefits of participating in the S-STEM Program cited by the students were: (1) Networking with other students and the faculty. (2) The various speakers sharing their experiences during S-STEM meetings. (3) Money and the opportunity that the S-STEM program has given them. (4) Free Food during S-STEM meetings.

Suggested Areas of Improvement for the S-STEM Program were:
- More interactive group activities for the monthly meetings so students can work together more and learn.
- Improve the process of obtaining progress reports from the teachers.
- More advance notification of meetings with a fixed location.
- More social activities, like field trips and ‘real’ socials.
- More knowledge about co-op and careers. Students reported wondering how S-STEM program will interact with co-op jobs and students being off campus half the time.

**Academic Student Performance for the 2007-2008 Academic Year**

The cumulative grade point average (GPA) attained by these students in the following categories: < 2.75, 2.75 to 3.00, 3.00 to 3.25, 3.25 to 3.5, 3.5 to 3.75, and 3.75 to 4.00 out of a maximum of 4.00 is shown in Figure 5. The GPA average and cumulative GPA and standard deviation for each quarter of 2007-2008 attained by the S-STEM Scholars are given below:

<table>
<thead>
<tr>
<th>Quarter of 2007-2008</th>
<th>Quarter Grade</th>
<th>Cumulative Grade at End of Quarter</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Standard Deviation</td>
</tr>
<tr>
<td>Fall</td>
<td>3.28</td>
<td>0.62</td>
</tr>
<tr>
<td>Winter</td>
<td>3.13</td>
<td>0.50</td>
</tr>
<tr>
<td>Spring</td>
<td>3.12</td>
<td>0.54</td>
</tr>
</tbody>
</table>
Activities for Sophomore through Senior Years

Based on the evaluation received from the S-STEM Scholars, Table 4 an outreach **Structured Service Learning K-8 Program** is being developed with assistance from the UC College of Education, Criminal Justice and Human Services (CECH), which will be implemented in a new STEM K-8 Elementary School being developed close to the UC campus. The school’s activities and curriculum is being developed under the direction of CECH faculty. The whole effort is funded from a grant from Ohio Board of Regents. Each S-STEM Scholar will be required to perform 10 hours per quarter or 30 hours per academic year of volunteer service. The STEM K-8 Elementary School will be fully operational in August 2008. A volunteer service learning program is being developed for the S-STEM Scholars to participate with the mathematics and science teachers from the STEM K-8 Elementary School in one of the following possible service learning programs: Tutoring Program, Science/Computer Club, and After School Study Program. Scholars assisting mathematics and science teachers to create and teach lessons/activities/projects in the class to show real-world engineering applications of the concepts taught.

Before participating in any of the above programs, the S-STEM Scholars will participate in a 10 hours course on Instructional Planning offered by CECH addressing issues such as STEM achievement standards, lesson planning, instructional teaching models, the nature of students, developing cultural sensitivity, and evaluating student learning and teaching effectiveness. We will like the S-STEM Scholars to be involved in a creative activity, which provides them leadership skills and enhances their communication skills. Having a menu of programs
available, as listed above, will provide the flexibility to the students to choose a program that suits their interest and fits their educational schedule. The schoolteacher participation is essential in the programs, which will be coordinated by the CECH faculty.

Each year 5-7 women S-STEM Scholars will be selected for the UC summer ten-week Research Experiences for Women Undergraduates (REWU) program, which will pay a stipend of $4,000/student. In addition, 3-5 underrepresented S-STEM Scholars will be selected for the eight-week summer NSF funded REU program in the CoE at UC, which will pay a stipend of $1,600/month/student and funds for board and lodging. Student selection will be based on GPA, two recommendation letters, and an essay on why they wish to participate and how it relates to their career goals. These two Summer REU programs are designed to help increase their interest in graduate school. The participants will have an opportunity to work on an actual research project under the mentorship of a faculty member and doctoral student. Through a petition, summer REU students may use this experience as one of their required Co-Op assignments.

The Academic Year Research and Education Enrichment Experience (AYRE³) which will improve both student recruitment and retention by providing seamless mentorship and enrichment opportunities throughout their undergraduate education via three primary activities: 1) Undergraduate Research Program (URP), 2) Educational Training Program (ETP), and 3) High School Outreach (HSO). These activities will rely on (1) the energy and enthusiasm of dedicated professors who have funded research programs, (2) student research support provided by the Honors Program, and (3) the partnership with local secondary schools as part of the NSF Track II GK-12 Fellows Project funded for five years (July 2006 to June 2011). In the URP, students will work with faculty on ongoing research projects. Based on a WEPAN program, URP will begin with a Workshop that trains Mentors and Mentees on their roles and how to maximize program benefits. Students will also attend skill development workshops (e.g., How to Read a Technical Paper, How to Conduct Library Reviews and Bibliography Searches, How to Write an Abstract and a Technical Paper, How to Present a Technical Paper, Preparing a Final Report, etc.) offered by volunteer faculty members. In the ETP, selected students will participate with the NSF GK-12 Fellows project and take in Autumn/Winter an Instructional Planning course offered by UC’s College of Education. This course will be condensed into a 20 hours/quarter. evening course addressing various topics (e.g., STEM achievement standards, lesson planning, instructional teaching models, the nature of students, how to connect with students at a personal level, develop cultural sensitivity, and evaluating student learning and teaching effectiveness). Then, students will participate in a HSO program in the Winter/Spring. Students will be paired with doctoral students who are NSF GK-12 Project Graduate Fellows. With assistance from the Fellow, secondary school teacher, and faculty research mentor, the S-STEM Scholar will use their research as a context to develop a hands-on, technology-driven, inquiry-based activity that shows how community issues, that are important to secondary school students, relate to STEM skills. Students can also apply their ETP experience to count as Diversity Experience credits required as part of UC’s Breadth of Knowledge requirements for their undergraduate curriculum.

The Undergraduate Research Forum (URF), which will be the capstone experience of the Summer REU and AYRE³ programs and will be a voluntary formal presentation equivalent to
that at a national professional meeting. To provide such a venue, an annual URF will be held at UC in mid-May for ~ 75 undergraduates to present their faculty-supervised research. This conference will be open to the proposed project participants and other students conducting supervised undergraduate research in STEM disciplines at UC (e.g., students in Honors and other campus REU programs).

**Bridging Program to Graduate School (BPGS)**

Besides research fellowships and retention programs, most graduate students, and in particular minority students, benefit from bridge programs that support the transition from undergraduate to graduate studies [52]. As Reichert and Absher concluded, “It’s not so much the details of what successful [minority programs] do, rather it’s the care with which they do it” [53]. The proposed BPGS focuses on “Preparing for Academic Success” via a seminar series held during Autumn/Winter quarters for ~ 25 S-STEM Scholars upperclassmen and other students who are interested in graduate studies. Prominent volunteer researchers, teachers, and professionals will be invited to give these seminars (i.e., Orientation to Graduate Study, Scientific Inquiry in Engineering Research, Effective Speaking and Technical Presentation, Preparing Portfolios, Ethics in Research, Technology Transfer, and Intellectual Property Issues). Though Co-Coordinators will recruit seminar speakers, one S-STEM Scholar, in rotation, will be in charge of organizing the seminar and introducing the guest speaker. This encourages student ownership of seminars and provides visibility among their peers.

**Conclusions**

The S-STEM Scholarship has had significant impact in the College’s efforts to attract and enroll women and underrepresented ethnic students. From fall 2006 to fall 2007, the number of female freshman students has increased 26% (84 to 106 females) and the number of underrepresented ethnic students has increased 53% (32 to 49 ethnic students). We learned that competitive scholarship is essential for increasing underrepresented student enrollment and that even with this scholarship, many students chose other institutions that offered full ride scholarships. We also learned that 40% of underrepresented ethnic students have financial need compared to 30% of our majority students. With this need information we were able to choose the S-STEM candidates more strategically.

**Acknowledgements**

The authors would like to acknowledge the financial support provided by the National Science Foundation for the Award No. DUE-07569 and cost sharing funds provided by the University of Cincinnati. The authors also acknowledge the assistance provided in recruitment efforts by Ms. Julie Burdick during the planning year, 2006-2007, when she was the Director of Undergraduate Student Enrollment Management and Director of the Rowe Center for Women in Engineering (RCWE), College of Engineering, University of Cincinnati, Cincinnati.

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