

Attracting and Retaining Women and Underrepresented Groups in Engineering, Science, and Related Programs

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Abstract — *This paper describes the efforts of a scholarship and student services project at The Community College of Baltimore County, with the goal of recruiting and supporting women and underrepresented minorities interested in pursuing careers in engineering, computer science, and related fields. The program is funded by the National Science Foundation under its Scholarships for Science, Technology, Engineering, and Mathematics program. Criteria for these need-based scholarships include full-time student status, a required minimum grade point average, and U.S. citizenship or status as a permanent resident alien or refugee alien. An Attitude Survey Questionnaire is completed by awardees each semester. Results from surveys will be presented, in addition to data on transfers of awardees.*

Index Terms — *computer science, engineering, graduates, mentoring, minorities, NSF, retention, scholarships, science, success rate, transfer rate, underrepresented, women.*

WOMEN AND MINORITIES IN TECHNICAL FIELDS IN THE USA

Less than half of the freshmen intending to major in science and engineering fields complete a bachelor's degree in those fields within 5 years, and underrepresented minorities drop out of those majors at a higher rate than other groups [1]. Women especially face negative societal pressures when pursuing careers in science, computer science, engineering, and mathematics. In 2003, although women were 46% of the total U.S. workforce, they were 26% of the college educated science and engineering workforce [2]. African Americans, Hispanics, and other non-Asian/Pacific Islander ethnic groups were 24% of the U.S. population in 2003, but 10% of the college educated science and engineering workforce [2]. There was a 79% decline in the number of incoming undergraduate women interested in majoring in computer science between 2000 and 2008 [3]. Although 57% of U.S. undergraduate degree recipients in 2008 were women, in that year just 18% of computer and information sciences undergraduate degree recipients were women [3]. Among the 15 recommendations in the 2006 report of the Maryland Task Force on the Status of Women and Information Technology was a recommendation to, "Provide access to electronic and/or traditional mentoring for every computer science and engineering college student through employment to increase retention" [4]. Students who drop out of science, engineering, and mathematics programs often do so within their first two years of college. The potential of community colleges to increase the numbers of women and underrepresented groups in Science, Technology, Engineering and Mathematics (STEM) fields should not be underestimated. "For example, 64% of American Indian/Alaskan Native, 50% of African American, and 55% of Hispanic science and engineering bachelor's and master's degree recipients in 2004 and 2005 attended community colleges" [5]. "Compared with 4-year colleges, community colleges enroll greater concentrations of low-income, first-generation, minority, immigrant, part-time, older, and academically underprepared students. . . U.S. community colleges enrolled . . . about a third of all postsecondary students in the 2006-07 academic year"[6]. It has been projected that in 2010, 47.9% of the workforce will be female and 26% will be African American or Hispanic [7]. To meet the need for qualified computer scientists and engineers in the U.S., women and underrepresented minorities must be encouraged and educated to join the science and engineering workforce. Programs funded by the National Science Foundation (NSF), including Scholarships for Science, Technology, Engineering, and Mathematics (S-STEM), are intended to assist women and underrepresented minorities through the educational system and into successful careers in these fields.

INSTITUTIONAL BACKGROUND INFORMATION FOR CCBC

The Community College of Baltimore County (CCBC) is a public three-campus system serving the greater Baltimore metropolitan area. In Fiscal Year 2008, 33% of the credit students were enrolled in transfer programs, 62% were female, and 31% were African American. Fall 2009 credit enrollment at CCBC overall was 23,584 students of which 36% (8,557) were full-time students. In Fiscal Year 2009, of the 1,874 graduates who earned Associate degrees (1,578) or certificates (370), 60% were female and 25% were African American. Pell Grants, funded by the federal government, provide grants to low-income undergraduate and some postbaccalaureate students. The institutional rate of Pell awards provides one indication of the amount of financial need of its student population. At CCBC in the 2008-09

academic year, 26% of the credit students received a Pell grant. Of these Pell awardees, 54% were African American, and 72% were female.

CCBC data on Full-Time Enrollment and Associate's Degrees in Computer Science (CMSC), Engineering (ENGR), and related STEM programs in recent years are provided in **Table I**. There has been a 26% increase at CCBC in the percent of full-time students majoring in S-STEM eligible programs since Fall 2007 (from 5.8% to 7.3% of all full-time students in credit programs). Although females have consistently represented the largest portion of CCBC graduates and credit students over the past 5 years, the percent of women in CMSC and ENGR at CCBC over that time averaged 20% and 14%, respectively, as shown in **Table II**.

TABLE I

Number of Full-Time Program Majors, and Associate's Degrees Awarded in S-STEM Programs 2004-2009 at CCBC

Program	Number of Full-Time Program Majors						Associate's Degrees Awarded	
	Fall 2004	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009	FY 2008	FY 2009
Arts & Sciences*	156 of 977	171 of 1071	176 of 1103	120 of 751	57 of 356	32 of 203	30 of 187	13 of 80
Computer Science	106	108	91	97	106	143	6	6
Engineering	112	113	105	115	111	189	7	1
Environmental Science and Technology***	11	11	10	0	16	14	1	0
Science**	-	-	-	57	181	248	4	14
Total S-STEM:	385	403	382	389	471	626	48	34
% S-STEM:	5.4 %	5.7 %	5.6 %	5.8 %	6.6 %	7.3 %	2.9 %	2.2 %
All CCBC Credit Programs	7,09 3	7,04 9	6,84 6	6,66 0	7,17 2	8,55 8	1,6 54	1,5 78
<p>Notes: * Until Fall 2007, Biology, Chemistry, Physics and Mathematics were among 30 subareas under an Arts & Sciences Transfer Program. Nearly half the students in that program designated subcodes such as Biology, but degrees awarded did not specify the subarea. In Fall 2005, 16% of the students who designated subcodes within Arts & Sciences had selected the BIOL, CHEM, PHYS or MATH subcodes.</p> <p>** Effective 2008, a new A.S. in Science degree program requiring additional higher level mathematics and science credits was created/available for just the science and mathematics transfer programs. As a result, the number of students in the Arts & Sciences A.A. degree Transfer Program was reduced to those who had begun that program in previous years and were now trying to complete it.</p> <p>*** An Environmental Science A.S. degree Transfer Program was new in Fall 2008 as one of the areas offering the new A.S. in Science degree program. Prior to that date, there was an Environmental Science and Technology A.A.S. degree Career Program.</p>								

S-STEM SCHOLARSHIP PROJECT AT CCBC

The primary goal of four-year project, *STEM Scholars Community*, is to provide educational opportunities to low-income, academically talented CCBC students on all 3 campuses, through scholarships and student support services to promote full-time enrollment and degree attainment in STEM disciplines. The four-year project has these objectives:

- Recruit, enroll, graduate, and transfer increased numbers of students at CCBC, especially women and other underrepresented groups in STEM fields, in 7 targeted associate degree programs by providing scholarships, workplace skills through optional paid internships, and student support infrastructure to increase student success.

TABLE II
PERCENT OF FEMALES AMONG S-STEM PROGRAM MAJORS AT CCBC FROM FALL 2005 THROUGH FALL 2009

Program	Female Enrollment				
	Fall 2005	Fall 2006	Fall 2007	Fall 2008	Fall 2009
Arts & Sciences	62%	61%	62%	64%	66%
Computer Science	23%	19%	23%	17%	19%
Engineering	15%	14%	16%	13%	10%
Environmental Science	45%	41%	-	33%	39%
Science	-	-	62%	55%	59%
All CCBC Credit Programs	63%	63%	63%	62%	63%

- Provide these students with academic, career, and professional development opportunities to ensure a successful transition to a four-year institution of higher education, or to the workplace.
- Strengthen existing informal consortial arrangements between CCBC and local four-year institutions to provide awardees with transfer information, and to ease their transfer to four-year institutions.

This \$497,000 four-year NSF-funded project at CCBC provides scholarships of up to \$10,000 (but not to exceed unmet financial need) per year for full-time students with 2.8 GPA majoring in one of these 7 transfer programs: Biology (BIOL), Chemistry (CHEM), Physics (PHYS), Mathematics (MATH), Computer Science (CMSC), Environmental Science (ENVS), and Engineering (ENGR). Scholarship awards are made each semester beginning in Fall 2008.

The goal of the NSF-funded project is to increase the enrollment, graduation and transfer of students, particularly women and underrepresented minorities, in STEM programs at CCBC, and to provide awardees with academic, career, and professional development opportunities for transfer to a four-year institution [8]. Each scholarship was for up to \$10,000 per year, but not to exceed the student's unmet financial need as determined by completion of Free Application for Federal Student Aid (FAFSA). Scholarships are renewable provided the student meets the renewal criteria. Scholarship recipients must be: United States citizens, or Permanent Resident Aliens, or Refugee Aliens, at the time of application.

I. Recruiting and Selecting Awardees at CCBC

Recruiting for the S-STEM scholarship program at CCBC began in Spring 2008, pending notification of funding, with the creation of a tri-fold brochure promoting the program. Recruitment efforts have continued each semester through CCBC web pages and cable television, college newspaper, campus Financial Aid offices, the multicultural affairs office, advisors, STEM program department chairs and coordinators, faculty, and through the directors of mathematics, science, and technology at Baltimore County Public Schools. **Table III** provides Guideline Criteria for S-STEM Scholarship Eligibility at CCBC. A Grade Point Average (GPA) of 2.8 or higher is required for scholarship eligibility and renewal. Awardees also must demonstrate readiness to take MATH 083 Intermediate Algebra. An S-STEM Scholarship Board, including a representative from the Financial Aid Office and faculty representatives from the eligible programs, meets before each semester to evaluate applicants based on these criteria and select awardees. The Financial Aid officer screens applicants for citizenship status, and full-time student status, and posts awards to the Bursar's office. The semester award goes to the student's college account and can be applied to tuition, books, or fees. After those expenses are paid, any remainder is sent directly to the student to be used as needed. This meets many indirect educational expenses including transportation, childcare, and the basic living costs of food and shelter.

TABLE III
AWARD CRITERIA FOR S-STEM SCHOLARSHIPS AT CCBC

Award Criteria for S-STEM Scholarship Students at CCBC		
Type of Applicant	Criteria for Consideration	Application Deadline

Current High School Senior or Recent High School Graduate (within 5 years)	<ul style="list-style-type: none"> • High School GPA 2.8, or higher • Completion of Algebra II with B, or higher • Completion of 2 high school science courses with B, or higher. • CCBC Math Placement test level of MATH 083 Intermediate Algebra, or higher. • Selection of eligible STEM major program. 	
Current CCBC Student or Student Transferring to CCBC from Another College	<ul style="list-style-type: none"> • Cumulative GPA of 2.8, or higher • 12 or more credits earned within last 3 years • 6 credits of STEM coursework • Completed MATH 082 or higher, or CCBC Math Placement test level of MATH 083 Intermediate Algebra, or higher. • Selection of eligible STEM major program. 	June 1 for Fall
Other Potentially Promising CCBC STEM Student	<ul style="list-style-type: none"> • Cumulative GPA of 2.5, or higher • Earned 6 credits of STEM coursework • Completed MATH 082 or higher, or CCBC Math Placement test level of MATH 083 Intermediate Algebra, or higher • Letter of recommendation from STEM program faculty 	December 1 for Spring
Scholarship Renewal	<ul style="list-style-type: none"> • Completion of at least 12 credits with semester GPA 2.8 or higher in STEM program in previous semester 	
Notes: 1. Awardees who have earned an Associate degree at CCBC or earned a minimum of 45 credits at CCBC in a STEM program are eligible to apply for a "transfer" award to a four-year institution in a STEM program there. However, such a "transfer" award will be made for at most 2 semesters while the student is at the four-year institution. 2. Continuous MATH enrollment is required. That is, awardees must register for a MATH course each semester of award until all required mathematics for their STEM program is completed.		

II. Renewal and Probationary Awards

Each awardee's progress is monitored to determine whether they maintain eligibility from semester to semester. A probation procedure is established for students who come close, but do not meet renewal criteria. The semester probation option provides students who fall just short of completing 12 credits, or whose semester GPA falls slightly below 2.8, with another semester of scholarship aid while being tracked more closely. Each semester several recipients whose academic performance was significantly lower than required for renewal have lost their scholarships, and replacement scholars were found among new applicants. **Table IV** shows the number of new awardees for each semester of the project.

III. Efforts to Increase the Transfer Rate

The CCBC S-STEM program encourages awardees to continue their studies at four-year institutions. The project proposal designated up to 20% of its scholarship funds to "follow" awardees who transfer and assist their completion of bachelor's degrees in these fields for up to 2 semesters after transfer. To date, 16% (3/19) for Fall 2008; 12% (3/25) for Spring 2009; 31% (9/29) for Fall 2009; and 30% (8/27) for Spring 2010; or 23% (23/100) of all semester awards through Spring 2010 have been to CCBC awardees who have transferred to four-year colleges. CCBC faculty continue to mentor transferring awardees using email, phone and personal contact. To be eligible for the transfer scholarship awards, renewal scholarship students must have earned an Associate's degree, or at least 45 credits at CCBC, and provide documentation of their acceptance and full-time status at the four-year institution in a STEM major; unmet financial need; and successful completion of prior coursework in a STEM degree program. Offering students the option of transferring their S-STEM scholarship along with their credits to a four-year institution enables students to reach greater success in a STEM field. Awardees began transferring as early as Fall 2008 when three of the initial scholarship awardees who had received scholarships in Spring 2008 under the prior NSF-funded Computer Science, Engineering, and Mathematics Scholarships (CSEMS) program transferred. This feature draws attention to the possibility of transfer to a four-year school for students who otherwise might not have considered transfer.

IV. Career Days for Awardees

Each semester before classes begin, 1 or 2 required STEM Career Days are held for awardees to provide an orientation to the S-STEM scholarship program, an overview of STEM major program requirements, and activities including guest speakers or panelists from STEM occupations. For example, the program for the August 26, 2009, career day attended by 26 of 29 awardees is in **Figure 1**. This was the second of two Fall 2009 career days for awardees. A speaker on the previous day had discussed resume writing and interview techniques. The focus is on STEM career and transfer information. Before each semester, awardees complete mentoring agreement forms and meet over lunch with their mentors. Awardees also complete a Likert-scale Attitude Assessment Questionnaire, shown in [9]. The questionnaire was provided by Claudia Morrell, then Director of the Center for Women & Information Technology at the University of Maryland Baltimore County (UMBC) [10]. At about the midpoint of the semester, awardees and mentors

attend a Luncheon Seminar featuring guest speakers and discussions of the job and transfer application process. Another benefit of this scholarship program is that an S-STEM Internship Coordinator provides guidance to interested awardees in locating and securing internships in their fields. One faculty mentor arranged a full-day tour of Northrop Grumman Headquarters, in Linthicum, Maryland, in January 2010, for interested awardees. It was attended by 7 awardees and the internship coordinator, as well as other students who were not S-STEM awardees.

Time	Activity	Presenter
9:00 – 9:15	Welcome – Coffee & Donuts	
9:15 – 10:00	Engineering Program and Careers	Laura LeMire, ENGR Department
10:00 – 11:00	STEM Internships	Dr. Gwen Gilinger, Assistant Professor, BIOL Department
11:00 – 12:00	Biology Program and Careers	Dr. Gail Gasparich, Towson University, Biological Sciences
12:00 - 1:30	Lunch with Mentors and Program Coordinators	
1:30 – 2:00	Chemistry Program and Careers	Dr. Pauline Hamilton, CHEM Department
2:00 – 2:30	Mathematics Program and Careers	Dr. Peter Joyce, MATH Department
2:30 – 3:00	Overall Evaluation	All

FIGURE I.
PROGRAM FOR AUGUST 26, 2009 CAREER DAY AT CCBC FOR S-STEM AWARDEES

V. Mentoring of S-STEM Scholarship Awardees

High-quality connections between students and faculty can increase student retention in college. Astin identified the 3 most powerful forms of involvement contributing to student success as: "academic involvement, involvement with faculty, and involvement with student peer groups" [11]. Cohoon found that mentoring and providing encouragement to persist were effective interventions for retaining women in computing majors at the undergraduate level [12]. Many community college students are the first in their families to attend college. As a result, they may not have a relative to encourage and offer advice that can help them manage their studies. Having a specific faculty member assigned to them as a mentor who will remain with them throughout their college career can be an important factor in helping them achieve their career goals. Therefore, each S-STEM awardee is assigned a CCBC faculty mentor based on the student's major and/or campus. There are 7 faculty mentors from various STEM fields, including engineering, computer science, biology, and several from mathematics over all 3 campuses. Over two years of this project, the number of mentees for individual faculty mentors has ranged from 1 to 6. Faculty mentors meet at least once a month with their student mentees [13] [9]. To emphasize the importance of mentoring, all mentors and mentees submit monthly mentoring logs.

Each awardee creates an individually designed academic plan with the guidance of the faculty mentor, making sure that all general education and major course requirements are met. These Individual Academic Learning Plans are modified and updated until graduation, and beyond for transferring awardees. This "learning plan" helps the student gauge the amount of time and coursework necessary to complete his/her studies before transfer to a four-year institution and/or attainment of the associate's degree. Mentors also help the student research options for transfer to four-year institutions.

VI. S-STEM Scholarship Award Distribution

Beginning in Fall 2008, approximately 25 S-STEM scholarships per semester were awarded. As shown in **Table IV**, a total of 57 different CCBC students from seven eligible Associate degree programs received S-STEM Scholarship awards during the period from Fall 2008 through Spring 2010. Specifically, 19 awardees were in ENGR, 11 in BIOL, 11 in CHEM, 6 in MATH, 4 in CMSC, 4 in PHYS, and 2 in ENV5. Most (29) received the award for just 1 semester, and eighteen (18) received it for 2 semesters, 5 received it for 3 semesters, and 5 for all 4 semesters. The average length of award has been 1.8 semesters (100/57) as of Spring 2010.

A total of 18 awardees ($18/57 = 32\%$), 5 female ($5/17 = 29\%$), and 13 male ($13/40 = 33\%$), have transferred to four-year institutions as of Spring 2010: 4 transferred in Fall 2008, 1 in Spring 2009, 8 transferred in Fall 2009, 4 in Spring 2010, and 1 awardee transferred in Fall 2007 while he was a CCBC CSEMS awardee. Nine (9) awardees have transferred to the University of Maryland Baltimore County (UMBC), 4 others to the University of Maryland College Park (UMCP), and 1 each transferred to: George Washington University, Swarthmore College, University of Baltimore (UB), University

of Miami, and the University of Delaware. Major programs for those 18 who have transferred are: 9 ENGR, 4 BIOL, 2 MATH, 1 Forensic Science, 1 CMSC, and 1 PHYS.

TABLE IV.
CCBC S-STEM AWARDS FALL 2008 THROUGH SPRING 2010 BY PROGRAM, SEMESTER AND GENDER

Associate Degree Program	Fall 2008 Awards		Spring 2009 Awards		Fall 2009 Awards		Spring 2010 Awards		Totals through Spring 2010	
	F	M	F	M	F	M	F	M	F	M
BIOL	3	3	3	3	3	2	1	3	11	11
CHEM	0	2	0	3	3	5	1	2	4	12
CMSC	0	0	0	1	1	2	1	2	2	5
ENGR	2	7	2	8	3	8	3	7	10	30
ENVS	0	0	1	0	0	0	0	1	1	1
PHYS	0	0	0	1	0	0	1	2	1	3
MATH	1	1	1	2	1	1	0	3	3	7
Total Awards	6	13	7	18	11	18	7	20	31	69
Transfer Awards	0	3	0	3	4	5	3	5	7	16
New Awardees	6	13	4	10	6	7	1	10	17	40

DEFINING SUCCESS FOR S-STEM AWARDEES AT CCBC

Just as four-year colleges maintain data on the percentage of their students who graduate with bachelor's degrees 4, 5, or 6 years after entry, community colleges maintain data on the percentage of their students who transfer or graduate with an associate's degree 2, 3, or 4 years after entry. At CCBC, the 4-year transfer and graduation rate (which counts those who transferred to a four-year institution and/or graduated with an associate's degree) of all 2,554 new full-time CCBC freshmen matriculating in all programs in 2004 was 32% (24% transferred and an additional 8% graduated but did not transfer), 13% were still enrolled at a Maryland community college, and 55% had dropped out without transfer or graduation [14].

For the state of Maryland, the 4-year transfer and graduation rate of all 14,527 new full-time freshmen matriculating at Maryland public community colleges in 2004 was 35% (26% transferred and an additional 9% graduated but did not transfer), 12% were still enrolled, and 53% had dropped out from college. Among the 16 public community colleges in Maryland, the 4-year transfer and graduation rate ranged from a low of 15% to a high of 45%. Transfer and graduation rates for African American and Hispanic students in Maryland community colleges remain below the rates for White and Asian students. In the 2004 state cohort, the 4-year transfer and graduation rate for African American students was 22%, and the rate for Hispanic students was 29% [14].

As shown in **Table V**, the distribution of all credit students at CCBC in Fall 2009 by racial/ethnic group as self-described at course registration was as follows: White 53%, African American 34%, Asian 5%, Hispanic 3%, and Other/Unknown 5%. Both African American and Hispanic minority groups that have been under-represented in STEM fields nationally have been represented among the 57 S-STEM awardees (from Fall 2008 through Spring 2010) in proportions close to or greater than their population percentage at CCBC. In particular, 35% of the 57 awardees were White, 33% were African American, 21% were Asian, 7% were Hispanic, and 4% were Other/Unknown (includes Non-Resident Alien status).

TABLE V
CCBC ENROLLMENT AND S-STEM AWARDEES FALL 2008 THROUGH SPRING 2010 BY RACIAL/ETHNIC GROUP

Racial/ Ethnic Group	% of CCBC Fall 2009 Credit Enrollment	Number of S- STEM Awardees in Fall 2008	Number of S- STEM Awardees in Spring 2009	Number of S- STEM Awardees in Fall 2009	Number of S- STEM Awardees in Spring 2010	Total Number of S-STEM Awardees through Spring 2010	% of Total S- STEM Awardees
White	53%	4	8	11	14	20	35%
African American	34%	7	8	8	8	19	33%
Asian	5%	3	7	7	4	12	21%
Hispanic	3%	3	2	2	1	4	7%
Other/Unknown	5%	2	0	1	0	2	4%
TOTAL:	100%	19	25	29	27	57	100%

TABLE VI
PERCENT OF CCBC ENROLLMENT IN S-STEM ELIGIBLE PROGRAMS IN FALL 2009 BY RACIAL/ETHNIC GROUP

S-STEM Eligible Program	African American		Asian		Hispanic		White		Other/Unknown (includes NRA)	
CMSC	96	37%	22	8%	6	2%	111	43%	26	10%
ENGR	105	31%	31	9%	13	4%	153	45%	35	11%
ENVS	0	0%	0	0%	0	0%	22	96%	1	4%
Sciences (includes BIOL, CHEM, PHYS, MATH)	135	29%	47	10%	19	4%	195	43%	62	14%
TOTAL (1079 students):	336	31%	100	9%	38	4%	481	45%	124	11%

Table VI shows that African American and Hispanic minority groups that are under-represented in STEM fields nationally are represented among the 57 S-STEM awardees (from Fall 2008 through Spring 2010) in proportions greater than their percentage in S-STEM eligible programs at CCBC in Fall 2009. In particular, 31% of CCBC students in S-STEM eligible programs were African American and 4% were Hispanic, whereas 33% of S-STEM awardees (from Fall 2008 through Spring 2010) were African American and 7% were Hispanic.

Table VII shows that in Fall 2009, 67% of CCBC students in S-STEM eligible programs were male, and 55% were full-time students. Although women are underrepresented in the S-STEM Scholarship awards made at CCBC under this project in comparison to their percentage of CCBC credit enrollment (63%), they are represented in proportion to their percentage in S-STEM eligible programs (33%). To date, 32% (6/19) of awards for Fall 2008; 28% (7/25) of awards for Spring 2009; 38% (11/29) of awards for Fall 2009; and 29% (8/28) of awards for Spring 2010; or 32% (32/101) of the S-STEM semester awards from Fall 2008 through Spring 2010 were made to women. In the period from Fall 2008 through Spring 2010, 30% (17/57) of awardees were women.

TABLE VII
ENROLLMENT IN S-STEM ELIGIBLE PROGRAMS IN FALL 2009 BY FULL-TIME/PART-TIME STATUS AND GENDER

S-STEM Eligible Program	Full-Time		Part-Time		Total	Male	Female
CMSC	143	55%	118	45%	261	81%	19%
ENGR	189	56%	148	44%	337	90%	10%
ENVS	14	61%	9	39%	23	61%	39%
Sciences (includes BIOL, CHEM, PHYS, MATH)	248	54%	210	46%	458	41%	59%
TOTAL (1079 students):	594	55%	485	45%	1079	67%	33%

S-STEM AWARDEE ATTITUDE ASSESSMENT QUESTIONNAIRE

Our purpose in administering an Attitude Assessment Questionnaire to awardees each semester is to determine what factors influence awardees to select and persist in STEM fields. A subset of the 24 statements on the questionnaire was

utilized in the project evaluation process. Responses made by awardees to statements #1, 14, 16 and 24 were recorded. The responses made by all awardees are provided in **Table VIII**. For comparison, **Table IX** contains only the responses from underrepresented groups in STEM fields; that is, from females and African Americans, Hispanics, and other non-Asian/Pacific Islander minorities. Both tables contain data from the first year and a half of this project. The underrepresented awardees made up 74% of funded students in the first semester, 64% in the second semester and 55% in the third semester. Because of these large percentages, there is not much difference in attitude between the underrepresented awardees and all awardees. At least 63% of awardees responded “Agree” or “Strongly Agree” to each of these four statements in all three semesters. In Year One, 100% of awardees responded “Agree” or “Strongly Agree” to the statement, “I feel enthusiastic about my STEM major.”

TABLE VIII

RESPONSES OF ALL CCBC S-STEM AWARDEES TO SELECTED SURVEY STATEMENTS FROM FALL 2008 TO FALL 2009

	I feel enthusiastic about my STEM major		I intend to pursue a career in STEM area		STEM role models have had a positive effect on me		Having a mentor is vital to my success	
	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
August 2008 N=19	11%	89%	11%	74%	21%	42%	32%	42%
January 2009 N=25	16%	84%	22%	65%	23%	41%	38%	38%
August 2009 N=29	7%	90%	14%	79%	48%	34%	39%	39%

TABLE IX

RESPONSES OF UNDERREPRESENTED GROUPS AMONG CCBC S-STEM AWARDEES TO SELECTED SURVEY STATEMENTS FROM FALL 2008 TO FALL 2009

	I feel enthusiastic about my STEM major		I intend to pursue a career in STEM area		STEM role models have had a positive effect on me		Having a mentor is vital to my success	
	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree	Agree	Strongly Agree
August 2008 N=14	14%	86%	7%	79%	14%	50%	43%	36%
January 2009 N=16	12%	88%	27%	60%	33%	33%	38%	38%
August 2009 N=16	6%	88%	13%	73%	44%	38%	53%	27%

CONCLUSIONS

The S-STEM Scholarship program recruits and provides mentoring and financial support to women and underrepresented minorities in engineering, computer science, and related fields. Since Fall 2008, fifty-seven (57) students majoring in engineering, computer science, mathematics, and scientific fields received S-STEM scholarships for one or more semesters. S-STEM scholarship awards are limited to full-time students with U.S. citizenship or specific types of alien status. The project has been successful in reaching underrepresented minority (African American and Hispanic) students in these fields in numbers close to or greater than their population percentage among CCBC students. To date, forty percent (40%) of S-STEM scholarship awardees are African American or Hispanic.

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REFERENCES

- [1] National Science Foundation, National Science Board. 2003. *The Science and Engineering Workforce. Realizing American's Potential.* (NSB 03-69), Arlington, VA: National Science Foundation. Mar. 3, 2010. <http://www.nsf.gov/nsb/documents/2003/nsb0369/>
- [2] National Science Board. 2006. Science and Engineering Indicators 2006. Two Volumes. Arlington, VA: National Science Foundation (volume 1, NSB 06-01; volume 2, NSB 06-01A). Mar. 3, 2010. <http://www.nsf.gov/statistics/seind06/>
- [3] National Center for Women and Information Technology (NCWIT) (2009) By the Numbers. Mar. 3, 2010. <http://www.ncwit.org/pdf/BytheNumbers09.pdf>
- [4] Taskforce on the Status of Women and Information Technology (October 2006) In the Center of the Storm: Addressing the Challenges of Maryland's Tightening IT Labor Market. Mar. 16, 2010. http://csta.acm.org/Research/sub/Projects/ResearchFiles/WIT_Task_Force_Report.pdf
- [5] National Action Council for Minorities in Engineering (2009) Synergies: 2008 Annual Report. p. 8. Mar. 3, 2010. http://www.nacme.org/user/docs/NACME_AnnualReport2008.pdf
- [6] National Science Board (2010) Science and Engineering Indicators 2010. <http://www.nsf.gov/statistics/seind10/c2/c2s1.htm>
- [7] Bureau of Labor Statistics. *Civilian Labor Force by Sex, Age, Race and Hispanic Origin, 1980, 1990, 2000, and Projected 2010.* Mar. 3, 2010. <http://www.bls.gov/opub/mlr/2001/11/art2tab.pdf>
- [8] Community College of Baltimore County. *S-STEM Scholarship Web Site.* Mar. 3, 2010. <http://ccbcmd.edu/stem/sstem.html>
- [9] Mento, B., Sorkin, S. and Prettyman, T. (2008). Encouraging Women and Minorities to Attain Degrees in Computing and Related Fields. *Information Systems Education Journal*, 6 (13). Mar. 3, 2010. [http://isedj.org/6/13/ISEDJ.6\(13\).Mento.pdf](http://isedj.org/6/13/ISEDJ.6(13).Mento.pdf) ISSN: 1545-679X.
- [10] University of Maryland, Baltimore County. (2006) Center for Women & Information Technology. Mar. 3, 2010. <http://www.umbc.edu/cwit/>
- [11] Astin, A.W. Involvement in Learning Revisited: Lessons We Have Learned. *Journal of College Student Development.* v.37, n.2, 1996. pp. 123-134.
- [12] Cohoon, J.M., Must There Be So Few? Including Women in CS. Invited Keynote Paper. *Proceedings of the 25th International Conference on Software Engineering.* May 2003. pp. 668-674.
- [13] Sorkin, S., and Mento, B. Collaborating to Promote Computer Science, Engineering, and Related Programs with Scholarships and Student Support Services. *9th International Conference on Engineering Education.* Mar. 3, 2010. <http://www.icee.usm.edu/icee/conferences/icee2006/papers/3293.pdf>
- [14] Maryland Higher Education Commission. *Retention, Graduation and Transfer Rates at Maryland Community Colleges, June 2009.* <http://www.mhec.state.md.us/publications/research/AnnualReports/2009RetGradTransRatCCs.pdf>