In this issue:

Strategies for Increasing IT Enrollment: Recruiting, Retaining and Encouraging the Transfer of Women and Underrepresented Groups to Four-Year Colleges

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Strategies for Increasing IT Enrollment: Recruiting, Retaining and Encouraging the Transfer of Women and Underrepresented Groups to Four-Year Colleges

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Abstract

Through the support of the National Science Foundation, The Community College of Baltimore County has begun two separate initiatives to increase the number of women and underrepresented minorities enrolled in technological majors. Started in 2003, the Grace Hopper Scholars Program targets specifically women interested in careers in technology, regardless of their financial status, enrollment status or grade point average. The second of these programs, begun in 2004, is a Computer Science, Engineering, and Mathematics Scholarship Program, that offers need-based scholarships for full-time students with a minimum grade point average, and U.S. citizenship or status as a permanent resident alien or refugee alien. Outcomes for the Grace Hopper Scholars Program comparing the success of GHSP students with respect to their enrollment status, will be provided. Attitudes of CSEM scholars according to gender and whether or not they are from underrepresented groups will be described.

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1. WOMEN AND MINORITIES IN IT FIELDS IN THE U.S.

The U.S. Department of Education reports that, in fall 2004, approximately 5.5 million undergraduates were enrolled part time, making up 37 percent of the undergraduate enrollment in all degree-granting postsecondary institutions. (NCES, 2007) Furthermore, according to the Center for Policy Analysis at the American Council on Education, "The nation's community colleges witnessed tremendous growth in enrollment during the 1990s, outpacing all other major postsecondary institutions". (ACE, 2004)

In its 2006 report, *In the Center of the Storm: Addressing the Challenges of Mary-*

land's *Tightening IT Labor Market*, the statewide Task Force on the Status of Women and Information Technology (Taskforce, 2006) noted that new enrollments in computer science departments had dropped by 46 percent since 2001. (CRA Taulbee, 2006) Quoting from its Executive Summary, "Current research indicates that increasing women's participation in IT and related technologies is the fastest and potentially most effective method for addressing the looming workforce shortages." There was a 70% decline in the number of incoming undergraduate women choosing to major in computer science between 2000 and 2005. (NCWIT, 2007) After two years of in-depth research and work on the issues and their impacts, the Task Force developed 15 recommendations for expanding education opportunities and supporting the recruitment and advancement of women in IT and related technologies in the workforce. One of those recommendations is to, "Provide access to electronic and/or traditional mentoring for every computer science and engineering college student through employment to increase retention." (Taskforce, 2006)

According to the 2006-2007 Taulbee Survey, the proportion of females among computer science bachelor's degree recipients at major research universities has continued to fall to a low of 12% from its peak of 19% in 2000-2001. (CRA Taulbee, 2008) The fastest-growing major segment of higher education is community colleges. (NSB, 2004) In 2003, although women were 46% of the total U.S. workforce, they were only 26% of the college-educated science and engineering workforce (NSB, 2006). 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 (NSB, 2006) It has been projected that in 2010, 47.9% of the workforce will be female and 26% will be African American or Hispanic (BLS, 2001). To meet the need for qualified IT employees in the U.S., women and underrepresented minorities must be encouraged and educated to join the IT workforce. Although 59% of 2006 U.S. undergraduate degree recipients were women, in that year just 21% of computing and information sciences undergraduate degree recipients were women. (NCWIT, 2007). The National Science Foundation (NSF) funds programs

such as Computer Science, Engineering, and Mathematics Scholarships (CSEMS), and Advanced Technological Education (ATE) student support projects like the Grace Hoppers Scholars Program (GHSP), designed to provide guidance and continuing support to women and underrepresented minorities from the beginning of their experiences in higher education until they reach their goal of a career in science, technology and mathematics.

2. INSTITUTIONAL BACKGROUND INFORMATION FOR CCBC

Because of their location, tuition, and open-enrollment policies, Community Colleges are an affordable option for students. "The Role of Community Colleges in the Education of Recent Science and Engineering Graduates", published by NSF stated, "The two most important reasons for attending a community college were to complete credits toward a bachelor's degree (74 percent) and to gain further skills and knowledge in an academic or occupational field (50 percent). Earning an associate's degree ranked sixth out of the nine reasons ranked." (Tsapogo, 2004) Furthermore, "On average 44 percent of Science and Engineering graduates went to a community college." (Tsapogo, 2004)

The Community College of Baltimore County (CCBC) is a public system with three main campuses and two extension centers that serve the suburban Baltimore metropolitan area. Technology has always been an important component of teaching and learning at CCBC. In Fiscal Year 1999, the college ranked among InfoWorld magazine's top 100 leaders in information technology. Its Fiscal Year 2008 Budget states that CCBC serves approximately 68,000 credit and non-credit students (CCBC, 2007). Fall 2007 credit enrollment at CCBC overall was 19,426 students of which 34% (6,660) were full-time students. Nearly two-thirds of CCBC students are enrolled part-time. The most recent data shows that 40% of the credit students were enrolled in transfer programs, 62% were female, and 31% were African American. In FY 2007, the total number of Associate's degrees awarded at CCBC was 1,410 of which 55% were Transfer Degrees, and 45% were Career Degrees. Of the 1,718 graduates who earned either Associate degrees (1,410 awards) or certificates (375

awards) in FY 2007, 62% were female and 20% were African American. Pell Grants, funded by the federal government, provide grants to low-income undergraduate and some post-baccalaureate students. At CCBC in the 2006-07 academic year, 24% of the credit students received a Pell grant. Of these Pell awardees, 55% were African-American, and 73% were Female.

An internal report by the research office of CCBC showed that from 2003 to 2006, the enrollment of males in computer science dropped 37.9% and the enrollment of females in computer science declined 51.5% at CCBC (Leitherer, 2007). CCBC data on Full-Time Enrollment in Computer Science (CMSC), Engineering (ENGR) and related programs are provided in **Figure 1** (in the Appendix). 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, Multimedia Technology (MULT) and Computer Graphics/Visual Communication (CGVC) has decreased during that time, as shown in **Figure 2**.

Just as 4-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 2,480 new full-time freshmen matriculating in all programs in 2002 was 32% (24% transferred, and an additional 8% graduated but did not transfer), 12% were still enrolled at a Maryland community college, and 56% had dropped out without transfer or graduation. (MHEC, 2007) For the state of Maryland, the 4-year success rate of all 13,978 new full-time freshmen matriculating at Maryland public community colleges in 2002 was 34% (25% transferred, and an additional 9% graduated but did not transfer), 11% were still enrolled, and 55% had dropped out from college. (MHEC, 2007) Among the 16 public community colleges in Maryland, the four-year transfer and graduation rate ranged from a low of 16% to a high of 41%. 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 2002 state cohort, the 4-year transfer and graduation rate for African American students was 20%, and the rate for Hispanic students was 30%. (MHEC, 2007)

3. AN OVERIEW OF THE GHSP PROJECT AT CCBC

In 2000, published reports from the American Association of University Women Educational Foundation stated that women compose about 20% of the IT professionals in the United States and obtain about 28% of the Computer Science degrees. (AAUW, 2000) The NSF-funded Advanced Technological Education (ATE) project, *Increasing the Number of Women in Computer Fields: A Community College Approach* (DUE-0302845) has used proven strategies for recruiting and student services to create the Grace Hopper Scholars Program (GHSP). With NSF support, CCBC recruited a total of 74 women interested in careers in computer science and related fields. The GHSP assisted students to reach their potential through various means. Scholars are provided with multiple learning experiences and support services including mentoring, tutoring, bridge programs, networking opportunities, and career oriented workshops. Each student can qualify for a $300 reimbursement for the completion of their first credit mathematics or computer course with a grade of C or better.

Recruitment and Participation Agreement

Recruitment has generally occurred through faculty referrals, but mailings and classroom visits have also been effective. Placement scores were not an effective way of recruiting participants. Interested applicants are given a participation agreement which outlines both what the program offers them and what the program expects of them. The participation agreement is available to the students online and lists the minimal length of the stay in the program, options for attendance in selected events, guidelines for being mentored, and an agreement to grant the GHSP leadership team and the researchers at the NSF access to student academic records (major, course work, grades). (CCBC GHSP, 2008) Applications are accepted throughout the year and students are

accepted regardless of grade point average, enrollment status or financial need.

GHSP Interventions for Success

Interventions have been carefully planned and designed to provide the scholars with meaningful learning experiences. They range from onsite company visits to networking events and bridge programs. Part of a mandatory summer bridge program involves giving students a learning styles assessment so as to best help them prepare for their learning environment. The summer bridge also involves hands-on computer workshops, seminars on financial aid opportunities, test anxiety, math anxiety, resume writing and job interviewing skills. Over time the summer bridge content was adjusted to the needs of GH scholars and panel discussions with female role models and transfer students from 4-year schools were added. At the 2008 summer bridge event, one of their peers shared valuable experiences with the Grace Hopper scholars after returning home from a summer long internship at the Office of Fossil Energy at the Pacific Northwest National Laboratory, a lab of the Department of Energy. Support from the Northrop Grumman Corporation has continued, allowing us to make an onsite company visit an annual event for GH scholars.

Mentors: Each Grace Hopper Scholar has been assigned a mentor. Mentors have gone through formal training from the Maryland State Resource Center. Scholars are required to maintain contact with their mentors at least twice a semester. The first contact is usually at the start of the semester to see how the scholar is progressing. The second contact is towards the end of the semester to help scholars plan their next semester. Although mentors and students were initially paired based on majors, the more successful pairings occurred when mentors and students were matched based on common interests outside of education. Mentors as well as faculty are also a source for letters of recommendation.

Course Reimbursements: In addition to the above aspects of the program, project staff also created a course reimbursement policy for scholars enrolled in the program for successful completion of their first credit math or computer technology course with a grade of C or better. This powerful incentive

seems to work well for GH scholars. After a four year tracking period, 66% (49/74) of Grace Hopper Scholars have qualified for course reimbursement. As **Figure 3** shows, more part-time students are successfully completing the upper level CINS courses at CCBC (5 part-time students vs. 1 full-time students) while more full-time students are completing the upper level math courses (7 part-time vs. 9 full-time). Anecdotal evidence suggests one possible explanation could be that many part-time GH scholars are already in the workforce and just take courses at the college to update their technical skills; full-time scholars on the other hand could be more focused on the successful completion of their advanced math requirements before transferring to a technology major at a 4-year school.

Student Evaluations of GHSP Program

Throughout the entire grant period, project staff worked with an external evaluator who consistently monitored the progress of the project. Once a year, she conducted focus group meetings with the scholars at the annual summer bridge event which enabled us to make program changes according to student suggestions; she also wrote yearly evaluations for the NSF. In Spring 2008, the final Grace Hopper Scholars Program Participant Survey was conducted among 50 students for whom contact information was available. Out of 50 students contacted, 25 responded to the survey. Of the 25 students who did not respond, at least three attempts were made via email, and/or telephone. The survey consisted of a total of six questions of which three provided "Strongly Agree, Agree, Disagree, Strongly Disagree, Not Applicable, No Response" rating options. Three additional questions were open ended. Results are as follows:

- 18 out of 25 scholars or 72% strongly agreed or agreed that "GHSP has helped them succeed in the computer science and/or information technology courses they have taken at CCBC" (Disagree:0, Strongly Disagree: 0, Not Applicable: 5, NO Response: 2)

- 14 out of 25 scholars or 56% strongly agreed or agreed that "GHSP has helped them succeed in the mathematics courses they have taken at CCBC"

(Disagree:2, Strongly Disagree: 0, Not Applicable: 7, NO Response: 2)

- 15 out of 25 or 60% strongly agreed or agreed that "GHSP has helped them attain (or remain on track to attain) a career in a computer-related field" (Disagree:2, Strongly Disagree: 0, Not Applicable: 7, NO Response: 1)

When asked, "What has been the most beneficial aspect of participating in the Grace Hopper Scholars Program?", close to 50% of the responses revealed that students wanted to belong to a group of women with similar interests and career goals. They had the desire to network and "obtain real-world advice from women in their [specific] career field". Students also mentioned faculty support, mentoring, financial aid and available seminars as most beneficial aspects of the program. As two students put it, "It [GHSP] was the place where you felt cared about," and "where you got insight of computer-related fields". When asked "Is there anything you would suggest changing about the program in the future?", almost half of the scholars indicated "No" in their response. However, several students suggested having more planned field trips throughout the year. One student verbalized her field trip experience to a local technology company as follows: "I had the opportunity to visit Northrop Grumman for the first time ever, and it was one of the best experiences that I ever had." Another student made her mark saying, "that we should put out more events to get more students involved in the program. This is really a good program that will guide unsure students to find their path in careers." Fifty-nine percent (59%) of GH scholars were enrolled part-time in the Grace Hopper Scholars Program. There seems to be more demand for group activities that also benefit part-time students. As one part-time student put it, "Since I have been in the workforce and go to school part-time, it is difficult to always be able to attend different events; I miss some networking opportunities, since I don't have some of the freedoms of the full-time students. Also, [it would help], if there are scholarships available for part-time students."

Evaluation of GH Student Performance

Approximately two-thirds of CCBC students are enrolled less than full-time. Although some part-time students share common characteristics with full-time students, most do not. The National Center for Education Statistics states that, in 2003-04, "83 percent of exclusively part-time undergraduates worked while enrolled, more than one-half (53 percent) of them worked full time, and 47 percent considered themselves primarily employees." (NCES, 2007) The study goes on to say that, "Exclusively part-time students were less likely 'to major in all fields except for computer or information science, health, and vocational or technical fields'." Their study estimated that about five percent of part-time students who declare a major, declare that major to be in Computer or Information Sciences.

Risk Factors for Non-Completion of Degree

In their "Descriptive Summary of 1995-1996 Beginning Postsecondary Students: Six Years Later," researchers Berkner, He and Cataldi reported that there were many factors that put students at a higher risk for not completing their degrees. "Two of the most important ones are part-time enrollment and delaying entry into postsecondary education after high school. Other factors are not having a regular high school diploma, having children, being a single parent, being financially independent of parents, and working full time while enrolled." (Berkner, 2002) Currently 70% (52/74) of Grace Hopper Scholars fit into *at least one* of these risk categories because of working full time, having family or children, being a single mother, having to take care of ailing parents, being financially independent of parents, or being enrolled part-time.

Progress of GHS by Enrollment Status

While GH data covers only the four years from 2004–2008, slightly over 27% of GH scholars (20/74) have obtained a degree or certificate and another 42 out of 74, or about 57% of GH scholars are still enrolled either at CCBC or enrolled at a four-year school, without having obtained a degree or certificate. See **Figure 4** in the Appendix.

Full-Time, Part-Time, and Mixed Enrollment Students: The U.S. Department of Education report defined three classes of enrollment status, exclusively full-time, exclusively part-time and mixed enrollment. A student's enrollment status was considered "mixed" if they changed their enrollment status either from full-time to part-time or part-time to full-time. A unique aspect of the Grace Hopper's Scholars program is that students are accepted into the GHSP regardless of their enrollment status. There are no probationary periods for any reason. While CCBC's Office of Planning Research and Evaluation reports provide strictly full-time and part-time enrollments, their studies show that 54 percent of students enrolled in technology-related majors that the Grace Hopper Scholars Program services were part-time students. As shown in **Figure 5**, within GHSP, a full 50 percent of GH scholars were part-time, with another 26 percent having mixed enrollment status over the 2004–2008 period. **Figure 6** shows the breakdown of part-time technology majors by program for all students at CCBC during the Fall 2007 semester. At CCBC, the CMSC, EBUS, MULT, and Science degree programs had a majority of their student majors enrolled full-time.

Figure 5:
Enrollment Status of Grace Hopper Scholars

Full Time 24%

Part Time 50%

Mixed 26%
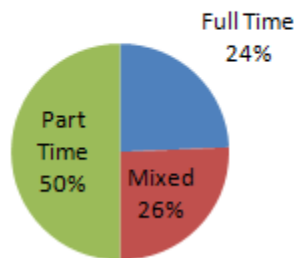
Since a large percentage of students enrolled at CCBC are what Berkner, et al. describe as high risk, the faculty involved with the Grace Hopper's Program felt it was important to examine the success, retention and performance rates of full-time, part-time, and mixed enrollment GHSP students. As of summer 2008, results show that only 8 percent of part-time GH scholars have received their associate's degree or certificate and another 3 percent of them have re-

ceived a bachelor's degree. However, 30 percent of part-time GH scholars have transferred to a four-year school without an associate's degree, and approximately another 38 percent are still enrolled at CCBC. This combines to nearly 69 percent of part-time GH scholars still being enrolled in higher education. Unfortunately, about 22 percent of part-time GH students have dropped out of either CCBC or a four-year school. Members of the GHSP project team are conducting further studies in an attempt to determine why these students have decided not to continue their studies. Preliminary evidence from a recent survey of those who dropped out is suggesting that work and family are the leading causes for dropping out.

For GHSP students with full-time status, 39 percent have received an associate's degree and another 6 percent have received bachelor's degrees. An additional 33 percent transferred to a four-year school without obtaining an associate's degree, 11 percent are still enrolled at CCBC, and 11 percent have dropped out of school. As of summer 2008, none of the full-time GH students have stopped at an AA degree or certificate. They have all transferred to a four-year college or university.

The students with mixed enrollment status performed with mixed results. While none of them have received bachelor's degrees, 42 percent received an associate's degree, 26 percent transferred to a four-year school without an associate's degree, 21 percent are still enrolled at CCBC, and 11 percent have dropped out of school entirely. **Figure 7** gives a graphical representation of these results.

Based on data from Berkner's *Beginning Postsecondary Students Longitudinal Study (BPS)*, the National Center for Educational Statistics stated in their "Part-Time Undergraduates in Postsecondary Education: 2003–04 Postsecondary Education Descriptive Analysis Report," that among 1995–96 beginning postsecondary students who started postsecondary education with a degree goal, for full-time students 65 percent received a degree or certificate, 9 percent were still enrolled, and 26 percent had dropped. (Berkner, 2002) As Figure 8, shows, for full-time Grace Hopper Scholars, 44 percent obtained a degree or certificate,

44 percent were still enrolled and 11 percent dropped. Mixed-enrollments in the BPS:96/01 study had 47 percent completing a degree, 23 percent were still enrolled and 30 percent dropped. For Grace Hopper Scholars, 42 percent achieved a degree, 47 percent were still enrolled and 22 percent dropped. Part-time students in the BPS:96/01 study had 15 percent obtain a degree or certificate, 15 percent still enrolled and 70 percent dropped. By comparison, for Grace Hopper Scholars 11 percent have obtained a degree, 68 percent are still enrolled and 22 percent have dropped out of school. There are several important differences between the BPS study and GHSP data. First, the BPS study was conducted over six years (1995-2001) and the GHSP study only covers four years. Additionally, GHSP research is only based on 74, compared with nearly ten-thousand in the BPS study. However, the authors are still encouraged by the GHSP results. These dropout rates are much lower than the 56% 4-year dropout rate for new full-time freshmen at CCBC, and the 70% dropout rate for part-time students in the BPS study. As **Figure 4** shows, a significant number of GH scholars have transferred to four-year colleges or universities without obtaining a degree at CCBC. Regardless of enrollment status, the GHSP also has a much smaller percentage of scholars who have dropped out of school. Finally, enrollment in the GHSP is remaining consistent for the program, with between fifteen and twenty scholars joining us each year.

4. THE CSEM SCHOLARSHIP PROJECT AT CCBC

The goal of the NSF-funded project, *Promoting Computer Science, Engineering, and Mathematics with Scholarships and Student Support Services,* (DUE-0422225), was to increase the enrollment, graduation and transfer of students, particularly underrepresented women and minorities, in CSEM programs at CCBC, and to provide awardees with academic, career, and professional development opportunities for transfer to a four-year institution, or for immediate employment. This project included funding for 29 scholarships per year, for four years beginning in Fall 2004. (CCBC, 2008) Each scholarship was for $3,125 per year, but not to exceed the student's unmet financial need as determined by completion of Free Appli-

cation for Federal Student Aid (FAFSA). Awards were made for half this amount on a semester basis. Scholarships were renewable provided the student met the renewal criteria. At CCBC, the 6 targeted Associate's degree programs were the Computer Information Systems (CINS), E-Business (EBUS), and Multimedia Technology (MULT) Career Programs, and the Computer Science (CMSC), Engineering (ENGR), and Mathematics (MATH) Transfer Programs. In compliance with NSF guidelines, scholarships were awarded only to full-time students in the targeted degree programs, and scholarship recipients had to be: United States citizens, or Permanent Resident Aliens, or Refugee Aliens, at the time of application.

Selection of CSEMS Awardees

Recruiting for the CSEM scholarship program at CCBC began in Spring 2004, pending notification of funding, and continued through the CCBC Web pages and cable television, campus Financial Aid offices, the multicultural affairs office, counselors, on-campus open houses, and faculty. Applications were accepted from high school seniors and from current CCBC students. Application deadlines were June 10 for Fall semester, and December 10 for Spring semester. A Grade Point Average (GPA) of 2.5 or higher was required for scholarship eligibility and renewal. Awardees also had to demonstrate readiness to take MATH 082 Introductory Algebra. A CSEM Scholarship Board, including a representative from the Financial Aid Office and faculty representatives from the eligible programs, met before each semester to evaluate applicants based on these criteria and select awardees. The Financial Aid officer screened applicants for citizenship status, and full-time student status, and posted awards to the Bursar's office. The semester award went to the student's college account and could be applied to tuition, books, or fees. After those expenses were paid, any remainder was sent directly to the student to be used as needed. This met many indirect educational expenses including transportation, childcare, and the basic living costs of food and shelter.

Probationary CSEMS Awards

Each awardee's progress was monitored to determine whether they had maintained eli-

gibility from semester to semester. A probation procedure was established for awardees who came close, but did not meet renewal criteria. The semester probation option gave students who fell just short of completing 12 credits, or whose semester GPA fell slightly below 2.5, another semester of scholarship aid while being tracked more closely. Each semester several recipients whose academic performance was significantly lower than required for renewal lost their scholarships, and replacement scholars were found among new applicants. **Figure 9** shows the number of new awardees for each semester of the project.

Mentoring and Other Support Services

Mentoring was an important aspect of the CSEMS program aimed at increasing retention by creating extra connections between students and faculty. 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 CSEMS awardee was assigned a CCBC faculty mentor based on the student's major and campus. Over the 4 years, the project involved 17 CCBC faculty mentors from its 3 campuses (Catonsville, Dundalk and Essex). Seven faculty remained mentors for the entire 4 years, and 10 others were involved for a year or more. Seven mentors were MATH faculty, the others were from these disciplines: CINS, CMSC, ENGR, MULT, and PHYS. Faculty mentors were to meet at least once a month with their student mentees. (Sorkin, 2006; Mento, 2008) To emphasize the importance of mentoring, all mentors and mentees submitted monthly mentoring logs. Early in the semester, meetings were more frequent so that obstacles to success could be overcome before they became insurmountable. The greatest loss of students in courses occurs early in the semester and often is because students do not know where to go for help. Each awardee created an individually designed academic plan with the guidance of the faculty mentor, making sure that all general education and major course requirements were met. These Individual Academic Learning Plans were modified and updated until graduation, and beyond for transferring awardees. This "learning plan" helped 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 helped the student to research options for transfer to four-year institutions. Many mentor/mentee interactions were informal, with an update on courses taken, projects underway, and attitudes toward college life. At CCBC, students are not assigned specific academic advisors, so the mentorship program is a major benefit for awardees.

Each semester before classes began, a required CSEM Career Day was held to provide an orientation to the CSEM scholarship program, an overview of program requirements, and activities for awardees including guest speakers or panelists from CSEM occupations. The focus was on career and transfer information. Before the semester, awardees completed mentoring agreement forms and a Likert-scale Attitude Assessment Questionnaire, and met with their mentors. An attitude survey was used to determine what factors influence students to select and persist in CSEM fields. To provide more information about transfer and careers, at about the midpoint of the semester, awardees and mentors attended a Luncheon Seminar Series featuring resume writing sessions, guest speakers, or a panel of recent graduates who are now employed or have transferred, and discussions of the job and transfer application process.

Distribution of CSEM Scholarships

Beginning in Fall 2004, approximately 27 CSEM scholarships per semester were awarded. A total of 75 different CCBC students from six Associate degree programs received awards during the four-year period from Fall 2004 to Fall 2008. Specifically, 16 awardees were in CINS, 12 in CMSC, 1 in EBUS, 26 in ENGR, 12 in MULT, and 8 in MATH. Some students received the award for just one semester; one received it for 8 semesters; and one received it for all 9 of those semesters. The average award was $1500 per semester, and the average length of award was 3.0 semesters. **Figure 9** provides the distribution of CSEM scholarship

awards by degree program, semester, and gender. **Figure 10** shows the distribution of CSEM awardees by racial/ethnic group as self-described at course registration. Forty-eight percent (48%) of the awardees were White, 31% were African American, 17% were Asian, and 4% were Hispanic. Both African American and Hispanic minority groups were represented among CSEM scholarship awardees in numbers greater than their population percentage at CCBC. In addition, 29% (64/224) of the semester CSEM scholarship awards were made to women, and 33% (25/75) of awardees were women.

Transfer Emphasis in the CSEM Project

Through its Career Days and Luncheon Seminars, this project encouraged awardees to continue their studies at 4-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. In practice, 34% (76/224) of scholarship awards through Fall 2008 have been used for this purpose. 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 at least 30 credits at CCBC and provide documentation of their acceptance and full-time status at the 4-year institution in a CSEM major; unmet financial need; and successful completion of prior coursework in a CSEM degree program. Offering students the option of transferring their CSEM scholarship along with their credits to a 4-year institution enables students to reach greater success in a CSEM field. Awardees began transferring as early as Spring 2005 when two of the initial 22 scholarship awardees transferred. This feature drew attention to the possibility of transfer to a four-year school for students who otherwise might not have considered transfer.

CSEM Student Outcomes

For the 63 students who received CSEM awards at CCBC in the period from Fall 2004 through Spring 2007, the transfer and graduation rate had reached 78% after 4 years. That is, 64% (40/63) had transferred and an additional 14% (9/63) graduated but did not transfer; and 19% (12/63) were still

enrolled in CSEM programs at CCBC in Spring 2008. Details are in **Figure 11.** Of the 40 awardees (11 females and 29 males) who had transferred by Fall 2008, there were 21 (8 females and 13 males) who also received an Associate's degree at CCBC. One had earned Bachelor's and Master's degrees in mathematics. Another had earned a Bachelor's degree with dual majors in mathematics and physics, and is pursuing graduate studies in physics. Three others had earned Bachelor's degrees in Electrical Engineering, Information Systems, and Computer Science. Nearly half (18/40) of the transferring awardees transferred to the University of Maryland Baltimore County (UMBC), with 7 others transferring to the University of Baltimore (UB), and 15 transferring to 10 other public and private institutions.

This compares well with the 4-year success rate of new full-time freshmen matriculating at Maryland public community colleges in 2002, which was 34% (25% transferred, and an additional 9% graduated but did not transfer), 11% were still enrolled, and 55% had dropped out from college. (MHEC, 2007)

CSEM Student Attitude Surveys

The Attitude Survey Questionnaire administered to CCBC CSEM awardees each semester was provided by Claudia Morrell, who was then Director of the Center for Women in Information Technology at the University of Maryland, Baltimore County. (UMBC, 2006; Mento, 2008) A subset of the 24 statements on the survey was utilized in the evaluation process. The responses made by all awardees are provided in **Figures 12** and **13**. **Figure 12** contains the responses of awardees from groups that are not underrepresented in CSEM fields. **Figure 13** contains the responses from awardees from underrepresented groups in CSEM fields; that is, from females and African Americans, Hispanics, and other non-Asian/Pacific Islander minorities. Both figures contain data from the last semester that the awardees completed the attitude survey. At least 67% of awardees in their respective groups responded "Agree" or "Strongly Agree" to all four statements. The first three statements recorded attitudes that are very similar for both groups. The underrepresented awardees consistently had a stronger opinion about the positive effect of CSEM role models. **Figure 14** contains a side by side com-

parison for the responses (Neutral, Agree, and Strongly Agree) to the statement, "CSEM role models have had a positive effect on me." A chi square test of independence was performed to determine whether there was an association between the underrepresented status of an awardee and his/her response to the survey statement. The test statistic of 5.288 had a marginal p-value of 0.073. This could indicate a slightly stronger opinion of CSEM role models among the underrepresented awardees.

Additional analysis compared the attitudes of male and female students at their last semester completing the survey. Scores of 1-5 were assigned to the attitude survey responses (Strongly Disagree, Disagree, Neutral, Agree, and Strongly Agree). Questions addressing the effects of CSEM role models and mentors were examined. A two sample T test revealed that there was no significant difference in the mean attitudes scores of male and female students for either role models or mentors.

Follow up data concerning the awardees' transfer and degree status has been continuously collected on 63 awardees (41 male and 22 female). **Figure 15** contains this data for CSEM awardees from Fall 2004 - Spring 2007 as of Fall 2008. Seventeen (41%) of the male awardees and 13 (59%) of the female awardees have earned an associate degree. Because of the small sample sizes the Fisher's exact test was used to test the two sample proportions. The results showed that there is no difference in these proportions. Transfer rates were also compared. Twenty-nine males (71%) and 11 (50%) females have successfully transferred to a four-year institution. Again, the Fisher's exact test was used to test if the male awardees have a higher rate of transfer. The test yielded marginal results (p-value =0.088). This could suggest that the male awardees are more likely to continue to a four-year institution.

5. ACKNOWLEDGEMENTS

6. CONCLUSIONS

The Grace Hopper Scholars program and the CSEM Scholarship program have worked in complementary ways over a period of four years to recruit, mentor and provide financial support to women and underrepresented minorities in computer science, engineering and related technology fields. The programs served approximately the same number of students. GHSP served 74 students, and CSEMS served 75 students, with 12 students participating in both programs. There are distinct differences between the programs. CSEM scholarship awards were limited to full-time students with U.S. citizenship or specific types of alien status. GHSP services were available also to part time students and to those without U.S. citizenship. The CSEM program required 2.5 GPA for scholarship renewal; but GHSP had no such requirement. Both the CSEM and GHSP programs placed a strong emphasis on mentoring individual students and on providing career-oriented activities for participating scholars. CSEMS provides a scholarship of $3125 per year, but is need based while GHSP emphasizes and rewards the successful completion of any non-developmental mathematics courses (or technology courses if the student already completed their mathematics requirements) with a course reimbursement of $300. A total of 30/74 or 41% of GHSP participants transferred to a four-year school, and 40/63 or 64% of CSEM awardees transferred. Both projects were successful in reaching underrepresented minority (African American and Hispanic) students in these fields in numbers greater than their population percentage among CCBC students. Thirty-five percent (35%) of CSEM scholarship awardees were African American or Hispanic, and 42% of Grace Hopper Scholars were African American or Hispanic.

For the Grace Hopper Scholars Program, student and mentor participation was nearly all female; however, GHSP was not limited exclusively to women. The proportion of females was 92% for scholars and 66% for mentors respectively. On the other hand, despite efforts to recruit female students, CSEM awards were made to a decreasing percentage of females over the 4 year period--dropping from 41% of awards in year one, to 35% in year two, 25% in year three, and just 17% of awardees in year four.

Where Do We Go from Here?

Student responses from the 2008 GHSP Participant Survey lead us to believe that more emphasis needs to be placed on the specific circumstances of part-time students, particularly at community colleges. "A majority of exclusively part-time students (64 percent) attended public 2-year institutions, compared with 25 percent of exclusively full-time students," according to (NCES, 2007). And over the past two decades, the part-time student enrollment at community colleges has grown more quickly, increasing by 60.6 percent, whereas full-time enrollment increased by 25.3 percent. (Nettles, 2006) Because NSF-funded CSEMS and S-STEM (the successor to CSEMS) scholarships are awarded only to full-time students, about two-thirds of community college students are cut off from receiving funding for their STEM education through those means. A single course reimbursement has served as a powerful recruitment and retention tool to keep GHSP target population enrolled in courses and on track with their career goals. In addition, this solution is relatively low cost, and colleges may be able to secure funds from their local business partners. For example, the CSEMS and GHSP programs at CCBC recently received a monetary award that will be used for this purpose from the Northrop Grumman Corporation.

When asked "Would you recommend GHSP to your peers, and if so, what would you tell them about the program?," responses from the GHSP participant survey clearly indicate that mentoring is a valuable service to GH scholars. One student summarized the value of the Grace Hopper Scholars program as being, "One of the greatest programs that will assist you in meeting your career goals. An organization I would stay in even after graduation to mentor other women."

This goes well with findings of a study by MentorNet (funded by NSF under EEC-0639762) stating that, "Women and under-represented respondents were significantly more likely than their peers to report the importance of mentoring for degree completion." (MentorNet, 2008). The authors recommend mentorship programs, with internal and external mentors in the field, for STEM and technology majors. GHSP staff are cur-rently assisting Anne Arundel Community College with the establishment of a mentor program at that institution. The creation of a regional consortium of STEM mentors to work with IT students from several community colleges is also recommended.

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APPENDIX

Figure 1. Number of Full-Time Majors in CSEM Programs 2003-2007 at CCBC

Program	Number of Full-Time Program Majors				
	Fall 2003	**Fall 2004**	**Fall 2005**	**Fall 2006**	**Fall 2007**
CINS	263	174	102	89	82
CMSC	145	106	108	91	97
ENGR	103	112	113	105	115
MULT*	40	71	64	70	55
Totals for CSEM Programs	**551**	**463**	**387**	**355**	**349**
All CCBC Credit Programs	**7,026**	**7,093**	**7,049**	**6,846**	**6,660**
* The Multimedia Technology Program was approved in Fall 1999, and began offering the Associate degree in Fall 2000.					

Figure 2. Percent of Females among CSEM, CADD and Computer Graphics Program Majors at CCBC from Fall 2003 through Fall 2007

CCBC Program	Female Enrollment				
	Fall 2003	**Fall 2004**	**Fall 2005**	**Fall 2006**	**Fall 2007**
CADD	23%	26%	27%	30%	24%
CGVC	52%	49%	47%	41%	42%
CINS	40%	42%	37%	36%	38%
CMSC	27%	21%	23%	19%	23%
ENGR	15%	15%	15%	14%	16%
MULT*	41%	29%	21%	21%	22%
All Credit Programs	**63%**	**63%**	**63%**	**63%**	**63%**

Figure 3. Completion of Courses in Specified Fields by Enrollment Status for 74 GHS (with Percentages Corresponding to Enrollment Group)

	Full-Time Scholars (n = 18)		Mixed Scholars (n = 15)		Part-Time Scholars (n = 37)	
	At least one course at the 200-level	None at the 200 level but at least one course at the 100-level	At least one course at the 200-level	None at the 200 level but at least one course at the 100-level	At least one course at the 200-level	None at the 200 level but at least one course at the 100-level
CINS	1 (6%)	2 (11%)	2 (11%)	1 (5%)	5 (14%)	6 (16%)
CMSC	4 (22%)	0	0	0	0	0
MATH	9 (50%)	5 (28%)	7 (37%)	7 (37%)	7 (19%)	5 (14%)
CADD	2 (11%)	0	0	1 (5%)	1 (3%)	0
MULT	1 (6%)	0	1 (5%)	1 (5%)	0	0
CGVC	0	1 (6%)	3 (16%)	1 (5%)	2 (5%)	1 (3%)

Notes: CINS 101, a general education course, was not reimbursable.

Columns are mutually exclusive, but rows are not.

Classification of a students' enrollment status is made at the end of each semester, and not as commonly practiced, at end of third week.

Figure 4. Progress of 74 Grace Hopper Scholars as of Summer 2008 by Enrollment Status

	Graduated from 4-yr School	Transferred with Associate's Degree	Transferred without Associate's Degree	Associate's Degree or Certificate ONLY	Still Enrolled at CCBC	Dropped Out	Total # of Scholars
# of Part-time Scholars	1	0	11	3	14	8	37
# of Mixed Scholars	0	5	5	3	4	2	19
# of Full-time Scholars	1	7	6	0	2	2	18
Total # of Scholars	2	12	22	6	20	12	Grand Total 74

Note: The enrollment status for each mixed scholar has been determined at the end of each semester to account for course withdrawals.

Figure 5. appears in section 3.

Figure 6. Number and Percent of Part-Time Majors by Program in Fall 2007 at CCBC

Major Program	Number of Full-Time	Number of Part Time	Percent Part Time	Total Number in Fall 2007
CGVC	127	141	53%	268
CMSC	97	80	45%	177
CADD	24	52	68%	76
EBUS	30	21	41%	51
ENGR	115	116	50%	231
General IT	82	126	61%	208
MULT	55	40	42%	95
Network Technology (DCOM)	54	110	67%	164
Science (includes MATH)	57	37	39%	94

Figure 7
Breakdown of Grace Hopper Scholars Success
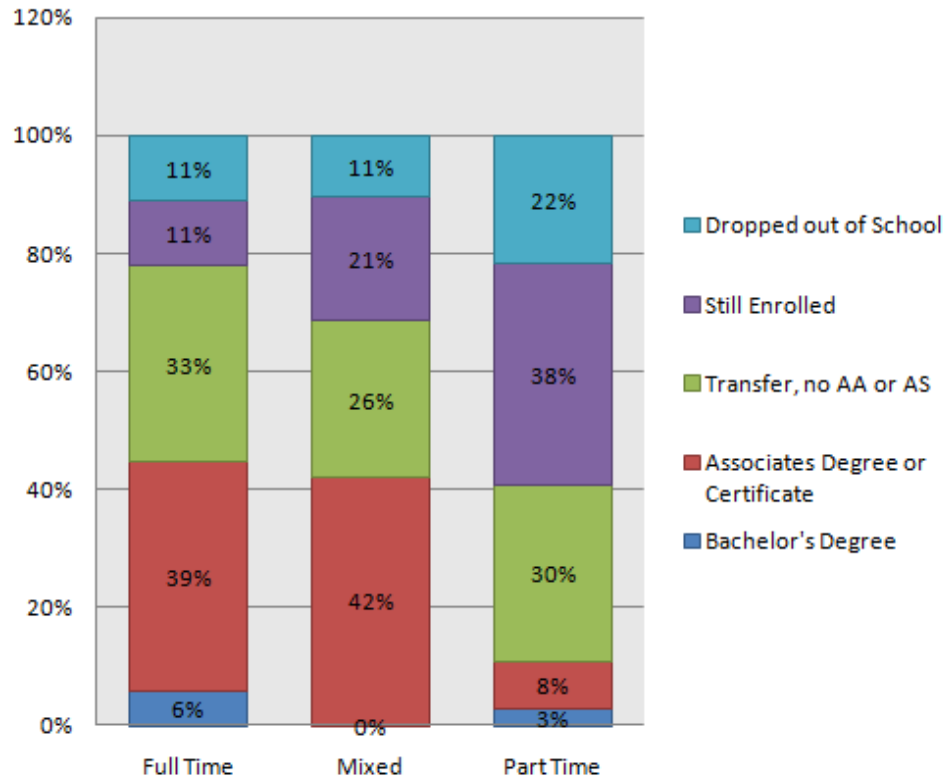
Figure 8. Comparison of 74 Grace Hopper Scholars Success Rates with Department of Education Statistics (Page 31 of Part-Time Undergraduates in Postsecondary Education: 2003-04 Postsecondary Education Descriptive Analysis Report)

	Grace Hopper Scholars			Department of Education Statistics		
	Full-Time	**Mixed**	**Part-Time**	**Full-Time**	**Mixed**	**Part-Time**
Degree or Certificate*	44%	42%	11%	65%	47%	15%
Still Enrolled**	44%	47%	68%	9%	23%	15%
Dropped Out	11%	11%	22%	26%	30%	70%
* *Degree or Certificate* means a bachelor's degree, associate's degree or certificate ** *Still Enrolled* means at CCBC or at a four-year transfer institution						

Figure 9. CCBC CSEM Scholarship Awards Fall 2004 through Fall 2008 by Program, Semester and Gender

Associate Degree Program		CINS	CMSC	EBUS	ENGR	MULT	MATH	Total Awards	Transfer Awards	New Awar-dees
F04	F	2	1	0	2	4	0	9	0	9
	M	2	2	0	4	3	2	13	0	13
S05	F	2	2	0	3	1	1	9	1	5
	M	1	2	0	5	2	3	13	1	4
F05	F	1	3	0	2	3	1	10	1	4
	M	6	3	0	5	3	2	19	4	9
S06	F	1	3	0	3	2	1	10	2	2
	M	5	4	0	4	2	3	18	7	4
F06	F	3	2	0	2	1	1	9	4	1
	M	7	2	0	6	5	4	24	9	10
S07	F	2	1	0	0	1	2	6	3	1
	M	5	3	0	3	6	4	21	8	1
F07	F	1	1	0	0	1	1	4	3	0
	M	6	2	1	7	4	3	23	12	6
S08	F	0	1	0	2	1	1	5	2	3
	M	5	2	1	6	3	3	20	10	3
F08	F	1	1	0	0	0	0	2	1	0
	M	5	1	1	0	2	0	9	8	0
Total	F	13	15	0	14	14	8	64	17	25
	M	42	21	1	40	29	25	160	59	50

Figure 10. CCBC Enrollment and CSEMS Awardees and GHSP Scholars Fall 2004 through Spring 2008 by Racial/Ethnic Group

Racial / Ethnic Group	% of CCBC Fall 2006 Credit Enrollment	Number of CSEM Awardees	% of Total CSEM Awardees	Number of GHSP Scholars	% of Total GHSP Scholars
White	57%	36	48%	27	36%
African American	31%	23	31%	29	39%
Asian	5%	13	17%	16	22%
Hispanic	2%	3	4%	2	3%
Other	5%	0	0%	0	0%
TOTAL:	100%	75	100%	74	100%

Figure 11. Outcomes for 63 CCBC CSEM Scholarship Awardees from Fall 2004 - Spring 2007 as of Fall 2008 by Racial/Ethnic Group and Gender

Racial / Ethnic Group	Transferred to Four-Year Institution *		Graduated with Associate's Degree		Still Enrolled at CCBC		Dropped Out	
	F	M	F	M	F	M	F	M
White	5 (4)	15 (9)	3	2	2	6	0	2
African American	2 (2)	8 (2)	2	2	2	0	0	0
Asian	3 (2)	6 (2)	0	0	0	1	0	0
Hispanic	1 (0)	0 (0)	0	0	1	0	0	0
TOTAL:	**11 (8)**	**29 (13)**	**5**	**4**	**5**	**7**	**0**	**2**
% of Females (n/22)	**50%**		**23%**		**23%**		**0%**	
% of Males (n/41)		**71%**		**10%**		**17%**		**5%**
% Combined (n/63)	**64%**		**14%**		**19%**		**3%**	

* Note: Numbers in parentheses show how many of those who transferred also earned associate's degrees.

Figure 12. Responses of Not Underrepresented CCBC CSEMS Awardees to Selected Survey Statements (Last semester survey responses) N = 34

Attitude Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel enthusiastic about my CSEM major	0	0	0	10 (29%)	24 (71%)
I intend to pursue a career in CSEM area	1 (3%)	0	2 (6%)	10 (29%)	21 (62%)
Having a mentor is vital to my success	2 (6%)	2 (6%)	7 (21%)	12 (35%)	11 (32%)
CSEM role models have had a positive effect on me	0	1 (3%)	7 (21%)	16 (47%)	10 (29%)

Figure 13. Responses of Underrepresented CCBC CSEMS Awardees to Selected Survey Statements (Last semester survey responses) N = 32

Attitude Statement	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
I feel enthusiastic about my CSEM major	0	0	1 (3%)	9 (28%)	22 (69%)
I intend to pursue a career in CSEM area	0	0	0	10 (31%)	22 (69%)
Having a mentor is vital to my success	0	0	8 (25%)	12 (38%)	12 (38%)
CSEM role models have had a positive effect on me	0	0	5 (16%)	8 (26%)	18 (58%)

Figure 14. Comparison of Responses to the statement, "CSEM role models have had a positive effect on me"

Group	Neutral	Agree	Strongly Agree
Not Underrepresented Awardees (N=33)	7	16	10
Underrepresented Awardees (N=31)	5	8	18

Figure 15. Transfer and Degree Completion by Gender among 63 CSEM Awardees from Fall 2004 - Spring 2007 as of Fall 2008

Group	Transferred	Associate Degrees	Bachelor's or Associate Degrees
Female Awardees (N=22)	11 (50%)	13 (59%)	14 (64%)
Male Awardees (N=41)	29 (71%)	17 (41%)	19 (46%)