

Building a Community of Successful Technology Scholars

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Abstract – *T4: Technology Training for Today and Tomorrow (T4 STEM)* is a project that provides educational opportunities to low-income, academically talented community college students through scholarships and student support services to promote full-time enrollment and degree attainment in STEM technology disciplines - specifically Engineering Technology, Networking Technology, Information Technology and Multimedia Technology. A total of 84 *T4 STEM* scholarships have been awarded over a period of four semesters to 40 different students (39% women and 59% historically underrepresented minority groups in STEM fields). Over the past two years, a community has been formed, comprised of the scholars and faculty mentors. To increase their likelihood of success, T4 STEM scholars worked with a mentor and attended workshops that included icebreaker activities, career presentations, and team building exercises. The workshops fostered bonding between the students, helping to develop a “technology community,” and provided the students with tools for future success in school and career.

Keywords: Community building, Scholarship, Technology, Community College

INTRODUCTION

There is a growing need for college graduates with technology degrees, particularly in Information Technology (IT), Networking Technology (NT), Engineering Technology (ET) and Multimedia Technology (MMT). The Community College of Baltimore County (CCBC) obtained a five-year NSF sponsored grant for a Science, Technology, Engineering and Math (STEM) project called T4: Technology Training for Today and Tomorrow (T4 STEM) to provide educational opportunities to low-income, academically talented CCBC students through scholarships and student support services to promote full-time enrollment and degree attainment in these STEM technology disciplines.

The *T4 STEM* program focuses on recruiting and retaining women and minorities in technology. The need for quality programs to encourage and support women, minorities and the disabled to pursue STEM fields for employment has been well documented in both industry and education. According to the U.S. Department of Commerce, America’s STEM workforce is crucial to the Country’s “innovative capacity and global competitiveness,” yet women hold less than 25% of STEM jobs even though they hold as many jobs as men in the U.S. economy [1]. On the academic side, the Maryland State Department of Education (MSDE) has declared 7 critical teacher shortage areas, including computer science, mathematics, and science [2]. Nationally, less than half of the freshmen intending to major in science and engineering fields complete a bachelor's degree in these fields within five years, and underrepresented minorities drop out of these majors at a higher rate than other groups [3]. The *T4 STEM* program is designed to retain women and minorities in the STEM technology field, by providing them with the support they need financially, socially, academically, and professionally.

Financially, a total of \$535,000 in scholarships is being awarded over a four-year period to students with at least a 2.8 GPA, majoring in one of the four technology areas specified. Students may receive up to \$5,000 per semester based on unmet financial need and the number of scholarships awarded. The scholarship budget increases \$15,000 each year to make funding available for new awardees while continuing to fund eligible returning scholars, including transferring awardees. While many technology students enter the workforce upon completion of their associate’s degree filling industry’s need for technicians, others continue on to get four-year degrees in technology, becoming technologists and/or becoming more qualified for higher level positions in their respective STEM field. The T4 STEM program encourages awardees to continue their studies by providing a scholarship for up to two semesters at a four-year institution.

The social, academic and professional support is provided through assignment of a mentor to each scholar, career and job finding skills workshops, and the formation of a T4 STEM community which provides a social network and support system many community college students lack due to work and/or family commitments.

METHODOLOGY

Recruitment

Throughout the spring and fall semesters, a variety of steps were taken to ensure an ample pool of applicants for the T4 STEM scholarships. Many professors within CCBC's School of Applied and Information Technology (SAIT), which houses each of the targeted technology programs, made students in their classes and advisees aware of the T4 STEM scholarship program throughout the semester. The application was posted on instructors' Blackboard sites and brochures were distributed to classes. Several weeks prior to the application deadline, the Dean of SAIT, issued a directive to all faculty within the School, to notify their CCBC students about the scholarship opportunity. The message was reinforced by the grant Primary Investigator (PI) and Co-PIs who are the department heads and coordinators of the four targeted technology programs. Representatives from the four programs also visited local high schools and met with students in technical programs that feed into CCBC to inform them about the T4 STEM scholarship and the opportunities available for them at CCBC. Brochures were also distributed by Financial Aid, Admissions offices and Student Advising on all three main campuses, and to administrative assistants and faculty in each of the technology areas. The application was also posted on the CCBC T4 STEM website (<http://www.ccbcmd.edu/t4stem/>) which contains scholarship eligibility criteria, expectations of recipients, mentor log forms, application deadlines and contact information in addition to the application form. The PI on the grant was the main contact person and

responded to email and phone inquiries from prospective and returning applicants. Information about the T4 STEM program was also shared through The Society of STEM Scholars, a student led organization of which the PI is a faculty advisor, and by the current scholarship recipients.

Selection

A Steering Committee comprised of representatives from the targeted T4 STEM programs areas, a Financial Aid officer, the SAIT Case Manager/Student Advisor, and SAIT's Director of Internships meet each semester to review applications and select scholarship awardees. The committee reviewed student transcripts and the application essay to verify the degree major, GPA, number of credits and math requirements were met. Under certain circumstances, applicants were considered for probationary awards.

Retention

To increase their likelihood of success, T4 STEM scholars met regularly with a mentor and attended workshops which included icebreaker activities, career presentations, and team building exercises. The workshops were designed to strengthen bonds between the students, helping to develop a "technology community" and provide the students with tools for future success in school and career. Workshop evaluations and an attitude survey were conducted each semester to determine the impact of the workshops and the project as a whole.

Mentoring is an important aspect of the T4 STEM program. Upon selection as a scholarship recipient, each awardee was assigned a mentor from their area of study. The responsibilities of the student and faculty member were clearly communicated at the Summer Career Experience and at each workshop. Awardees signed a Mentoring Agreement and submitted mentoring logs. Mentors were asked to meet with their assigned T4 STEM scholars at least every other week for the first six weeks of the semester and on a monthly basis thereafter to ensure the academic success of their mentees. Mentors worked with the students to develop and manage an Individual Academic Learning Plan (IALP) which helps the student gauge the amount of time and coursework necessary to complete his/her studies and ensure the courses are taken in the proper sequence.

To maintain their scholarship, students must complete at least 12 credits with a minimum 2.8 GPA. A probation procedure is used for those who fall just short of completing the requirements giving the student one semester to to regain their academic standing while continuing to receive financial aid, albeit at a reduced level, while being tracked more closely. The reduction in the scholarship award leaves more funds available for students who met all of the criteria and provides the scholar with additional incentive to improve their grades without encumbering them with the need to work extended hours to pay for school. Up to 20% of scholarship awards may be probationary.

The project allows for up to 20% of the scholarship funds awarded each semester to "follow" awardees who transferred to four-year institutions to assist their completion of a bachelor's degree. To be eligible for a transfer scholarship award, a renewal scholarship student must have earned an associate's degree, or at least 45 credits at CCBC. Transfer awardees continue to work with their CCBC T4 STEM mentor using email, phone and in-person meetings.

Attitude Survey

In order to determine what influences students to select and persist in STEM fields, an Attitude Survey Questionnaire, was administered to CCBC's T4 STEM scholars each semester.

RESULTS AND DISCUSSION

Scholarship Applications and Awards

Response to the scholarship notifications was very good with a diverse range of students from each of the four disciplines submitting applications during the first two years of the program. Over the four semesters, the number of applications has grown from 24 to 38 while the number of awardees has grown from 13 to 27. Many applicants were deemed to be ineligible due to lack of unmet need, low GPA, non-T4 STEM major, insufficient STEM credits to date, or less than 12 credits completed in the past two years. Data on the number of applicants and scholarships awarded is depicted in TABLE I. The award amount varied based on the amount budgeted for the year and the total unmet financial need of all scholarship recipients. Although the amount of money budgeted to be awarded increased from \$100,000 to \$130,000 the second year of the grant, the award amounts are lower due to the increase in the number of awards. In addition, more awards were made to T4 STEM scholars who had transferred to four-year institutions and had higher FAFSA based need.

TABLE I

T4 STEM SCHOLARSHIP APPLICATIONS AND AWARDS

Semester	Applicants	New Applicants	Ineligible	Scholarships Awarded	Scholarship Amount
Fall 2010	24	24	11	13	\$441 to \$5,000
Spring 2011	28	17	6	20	\$692 to \$4,825
Fall 2011	38	21	7	24	\$1,080 to \$2,950
Spring 2011	38	17	10	27	\$181 to \$3,350

Scholarships were awarded to a total of 40 different CCBC students over the two year period. The majority of the students were majoring in Networking Technology (14) and Information Technology (13), and the fewest (5) in Multimedia Technology (now Interactive Media). There were also eight Engineering Technology majors.

TABLE II provides the distribution of T4 STEM awards by degree program and gender by semester. Thirty-nine percent (20/51) of the semester awards in the second year, and 39% of the awards to date (33/84) were made to women.

TABLE II

T4 STEM AWARDS - FALL 2010 THROUGH SPRING 2012 BY PROGRAM, SEMESTER AND GENDER

Associate Degree Program	Fall 2010 Awards		Spring 2011 Awards		Fall 2011 Awards		Spring 2012 Awards		Year Two Totals		Year Two Totals by %		Totals through Spring 2012		Totals by % through Spring 2012	
	F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
IT	3	3	5	3	6	3	3	5	9	8	53%	47%	17	14	55%	45%
NT	1	2	1	4	5	3	4	7	9	10	47%	53%	11	16	41%	59%
ET	1	1	1	3	1	4	1	4	2	8	20%	80%	4	12	25%	75%
MMT	0	2	1	2	0	2	0	3	0	5	0%	100%	1	9	10%	90%
Total Awards	5	8	8	12	12	12	8	19	20	31	39%	61%	33	51	39%	61%
Transfer Awards	0	0	1	1	2	1	2	1	4	2	67%	33%	5	3	63%	38%
New Awards	5	8	4	6	5	5	0	7	5	12	29%	71%	14	26	35%	65%

Mentoring

Since traditional CCBC students are not assigned specific academic advisors to guide them through college, the T4 STEM mentorship program is a major benefit for awardees. Between 86% and 95% of the respondents to the T4 STEM Program Attitude Assessment Questionnaire believed that having a mentor was important to their success.

As the number of awardees grew, the number of professors acting as mentors for the T4 STEM scholars increased as well to allow the faculty members to spend more time with the students and better focus on their situation and needs. During the first semester of the grant, only the five faculty members on the Steering Committee were assigned mentees. It was found that mentors and mentees who were primarily on different campuses had difficulty meeting in person and, in general, did not contact each other as often as others who were on the same campus. As a result of these findings and due to the larger number of awardees, 12 additional professors were asked to participate over the following three award periods. In Spring 2011, three new faculty members were matched with scholars from their area of study located on the same campus. An additional six became mentors in Fall 2011, and one more professor was added in Spring 2012. An added benefit of having more faculty participating in the grant was the increased awareness and recognition of the program and stepped up recruitment efforts on the part of the new faculty members.

Workshops

Scholarship recipients were required to attend workshops alternatingly held on the east side and west side of Baltimore on the two main campuses. With few exceptions, the only students that missed the workshops had conflicts with classes at their transfer institutions, medical reasons, or were physically out of the state. The workshops were structured to include an icebreaker, career presentations, an interactive session on skills needed to find a job, and/or a team building exercise. During the pre-semester workshops, students also completed required

paperwork including a consent form, a mentor agreement, and an online T4 STEM Program Attitude Assessment Questionnaire.

Starting the first workshop of the semester with an icebreaker-type activity required the students to interact and learn something about each other and the faculty mentors. Having the students subsequently work in teams with other students from their discipline also enhanced interaction as faculty and returning scholars reached out to the new awardees to make them feel more welcome. Teambuilding activities included: identify the person bingo; identifying your own and understanding and relating to different Myers Briggs personality types; determining how best to become involved in the Society of STEM Scholars, a CCBC student organization; handling problems in team meetings; and communicating about conflict.

The level of interaction between the students increased with each team building session. During Fall 2011 workshop, the Associate Director of the Center for Women In Technology (CWIT) at the University of Maryland Baltimore County gave a presentation on the benefits of belonging to a community. Students were directed to write down the names of people who were part of their community, starting with those closest to them and expanding outward. When the students reported back to the group, each one discussed how the T4 STEM scholarship program was integral to their success and to the development of their community. For some students, everyone in their community stemmed from the T4 STEM program. One student stated that if it were not for the T4 STEM program, he would have dropped out of school. Another student wrote “Many in the T4 program are working adults and many have other obligations, so it is important to have a community who can empathize with what you are going through and that can help you prepare for the challenges ahead. Since many in the program come from all walks of life, the T4 community has been crucial in helping to deal with different personalities and situations.”

Sessions for finding employment were conducted by CCBC’s Director of Internships and included: applying for a job; getting the most out of a job description when applying for a position; resume writing, interview techniques and internships; the importance of being thorough; and fielding interview questions. In addition, faculty members and guest speakers, including alumni and T4 STEM transfer students, discussed careers in the four T4 STEM technical fields, entrepreneurship; and transferring to four-year institutions.

Based on an evaluation form students completed at the end of each workshop, verbal feedback, and observation, it was clear nearly all of the scholars and the mentors enjoyed the interaction. Feedback was very positive and each aspect of the workshop, including every activity, was found to be very beneficial.

Retention

The 84 T4 STEM scholarships awarded over the first two years (3 probationary) went to 40 different individuals: 14 (including the 7 new Spring 2012 awardees) received an award for just 1 semester; 13 received a scholarship for two semesters; 8 for three semesters; and 5 for all four semesters. Fourteen of the awardees have received an AAS degree in a T4 STEM major. The status of the T4 scholars at the end of the Spring 2012 is shown in TABLE III. The 8 students who were still enrolled at CCBC but no longer in the T4 STEM program were attending school part time, no longer had financial need, and/or were working to re-establish good academic standing. The three probationary awards effectively gave borderline students the opportunity to get back on the right academic track.

TABLE III

STATUS OF *T4 STEM* AWARDEES AT THE END OF SPRING 2012

No. of T4 Scholars	Status of 40 <i>T4 STEM</i> scholars
24	Attending CCBC pursuing AAS degree or additional certification in a <i>T4 STEM</i> major (16 currently in the T4 STEM program)
8	Currently enrolled in a four-year institution, full or part time (4 in T4 STEM program)
1	Graduated from a four-year institution, seeking employment
4	Employed in a T4 STEM career
3	Changed to a non-T4 STEM major

Transfer

Providing awardees with an opportunity to transfer their T4 STEM scholarship along with their credits to a four-year institution enables them to reach greater success in a STEM field. In the first year of the project, 10% (2/20) of the Spring 2011 awards were to T4 STEM scholars who had transferred, and in the second year, 13% (3/24) of the Fall 2011 awards and 11% (3/27) of the Spring 2012 awards were to T4 STEM scholars who had transferred to a four-year college or returned for an additional certificate in a T4 STEM program. A fourth student transferred without a T4 STEM scholarship into an engineering program.

Attitude Survey

Results of the survey consistently show that the vast majority (84 to 86%) of the scholars did not consider a T4 STEM major until college and only 7 to 11% first considered a T4 STEM major in high school. Recipients were very optimistic about their opportunities to find a job in a T4 STEM field with 87 to 95% believing there are either many opportunities or a high demand.

The survey results also showed the impact receiving a T4 STEM scholarship had on the awardees, with 80% to 100% of the responders strongly agreeing (65% to 83%) or agreeing (13% to 30%) that receiving the scholarship was instrumental to their staying in a T4 STEM program. Similar results were found for the impact of the workshops with 86% to 90% of the responders strongly agreeing (47% to 60%) or agreeing (30% to 42%) that participation in the workshops influenced them to remain in a T4 STEM program. All of the awardees taking the survey strongly agreed or agreed that they would likely continue in their T4 STEM major.

CONCLUSION

The T4 STEM program has been successful in a variety of ways. Designed to do more than provide financial aid to needy students, the program has successfully created a community of STEM technology students and helped them to succeed. Results of the first two years of the T4 STEM program demonstrate that it has been very effective in encouraging students to select Engineering Technology, Networking Technology, Information Technology or Multimedia Technology as a major; retaining students in the T4 STEM majors; and enabling awardees to graduate with an associate or bachelor degree.

The recruitment methods utilized resulted in a qualified pool of applicants from each of the targeted T4 STEM majors. Pairing the selected scholars with a mentor had a very positive impact on the students with 86% to 95% agreeing that having a mentor was important to their success. Enlisting additional mentors enhanced the program by increasing faculty involvement in the program and providing more individualized attention for the students.

Most importantly, the ice-breaker and teambuilding exercises included in the mandatory workshops resulted in the formation of a T4 STEM community. Through the interactive activities, students developed a network of friends and faculty to whom they could go for assistance, academic collaboration, information and/or support. Being a part of the T4 STEM community has influenced the scholars to remain in a T4 STEM program and to graduate.

REFERENCES

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Upon graduation from the University of Maryland with her masters in geotechnical engineering, Laura went to work for Baltimore Gas and Electric where during her career, she was responsible for substation construction projects, improving service reliability, and after obtaining her MBA, corporate purchasing and investor relations. Laura left the utility to become the Director of Women's Sports at STX, Inc., a sporting goods manufacturer where she became

the holder of four patents. Laura then obtained a Masters in environmental engineering from UMBC before becoming the Engineering Coordinator at the Community College of Baltimore County where she is growing the engineering transfer and engineering technology programs by stimulating interest in high school students, generating funding for students, and developing a STEM community. She is also the PI on two NSF grants.

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