A Model for Increasing Gender Diversity in Technology

Penny Rheingans
UMBC
Baltimore, MD
rheingan@cs.umbc.edu

Erica D'Eramo
UMBC
Baltimore, MD
deramo@umbc.edu

Crystal Diaz-Espinoza
Baylor University
Waco, TX
Crystal_Diaz-Espinoza@baylor.edu

Danyelle Ireland
UMBC
Baltimore, MD
direland@umbc.edu

ABSTRACT

At our university, women are a minority in all computing and engineering majors. This situation is mirrored at other universities nationwide, as well as in technical industries. Stereotype threat, the risk of confirming a negative stereotype about one's social group, can result in women not performing as well as their male counterparts in computing, mathematics, and engineering courses. The aftermath of these experiences cause women to fear they do not belong or are not "smart enough", resulting in women switching to a different major. Even high-performing women can be subject to these pressures. We present a Scholar model for increasing gender diversity in technology fields and an evaluation of its impact on the retention and success of women in computing and engineering majors. We compare the performance of Scholars to that of non-Scholars with similar demographic and academic backgrounds who entered into the College of Engineering and Information Technology at the University of Maryland, Baltimore County.

CCS CONCEPTS

• **Social and professional topics** → **Model curricula**; **Gender**; *Race and ethnicity*;

KEYWORDS

Diversity, Gender, Community, Scholar Programs

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1 INTRODUCTION

Engineering and computing are important fields at the forefront of solving the world's problems and maintaining American competitiveness. Employment opportunities in these fields remain strong, with the Bureau of Labor Statistics predicting that demand in these fields will outstrip supply in the coming years [3]. Drawing broadly from the available talent base of students with strong math and science backgrounds is essential to meeting this growing demand. Additionally, a diverse talent pool will help ensure better quality solutions to complex problems, as technologists with different life experiences bring those experiences to bear on crafting solutions. Simply put, a diverse pool of students in computing is critical in terms of both quantity and quality of graduates.

Nationally, women account for a relatively small fraction of computing and engineering students. In 2016, the percentage of women among those receiving Bachelor's degrees was 17.9% in computer science, 12.6% in computer engineering and 22.9% in informatics [11]. The percentage of computing degrees earned by women is much lower than it was in the 1980s, but has been creeping up in recent years. In most engineering disciplines, the situation is similar. In 2015, women received 32.4% of Bachelor's degrees in chemical engineering and 13.2% of degrees in mechanical engineering, with other engineering disciplines falling between. In both of these engineering disciplines, the national trend for women has been climbing slowly [10].

Potential theories abound for the persistence of extremely low percentages of women in computing fields. Proposed causes include problems with the public image of computing, a belief that computing careers preclude a family life, and stereotype threat. Stereotype threat describes the situation in which concern about being judged negatively according to a stereotype about one's group results in reduced performance or other negative effects [6]. Research on stereotypes indicates that academic performance is undermined by the extra pressure created by stereotype threat. Additionally, limited real-world relevancy of computing curricula, poor teaching and inaccessible advising in some computing departments, confidence issues in computing students, and more attractive options in other fields can encourage women to leave computing. These issues are not unique to the women in these fields, but underrepresented populations tend to suffer greater effects from adverse conditions.

The Center for Women in Technology (CWIT) Scholars program has proven to be effective at increasing persistence and graduation of women in computing and engineering at the University

of Maryland, Baltimore County (UMBC). This model involves a strong community of women and allies who work together to create a welcoming environment for women in technology. The very intentional, research-based elements of this program include multiple mentoring programs, a first-year experience course, academic and professional programming, staff support and advising, a living learning community (LLC), and community-building social events.

2 BACKGROUND

Women have remained underrepresented in computing with computer science being the only science, technology, engineering and mathematics (STEM) major experiencing a decline in the representation of women at the undergraduate level [1]. The academic experience for women in STEM can be characterized by isolation, a lack of mentors, and a shortage of role models [2]. Attrition typically happens after the first year in college and may be caused by a lack of a sense of belonging and a lack of self-confidence during the first year [9]. Additionally, there is evidence that suggests stereotypes about computer science (often negative) are powerful influences for women considering careers in the field [1].

Research also emphasizes the effect of peers on women in STEM. While female peer interactions can have a positive impact on women within STEM majors or when deciding to enter STEM majors, negative social interactions with male peers within study groups or social circles can negatively influence a woman's decision to persist in STEM [5]. Additionally, peer-to-peer interactions have been shown to positively affect the development and retention of college students [8]. Academic and social support are key to increasing the persistence and advancement of women and underrepresented minorities in STEM [4]. The development of women's self-concept is greatly improved when receiving encouragement from role models at school [7]. The CWIT Scholars Program is designed to offer women in computing an environment that counteracts many of these negative influences through an engaging and supportive community of peers, allies, and role models.

3 INSTITUTIONAL CONTEXT AND GOALS

Situated between Baltimore and Washington, DC, UMBC is a mid-sized, public research university of approximately 14,000 students, about 11,000 of them undergraduates. UMBC is among the top three research universities in information technology degrees awarded nationally. UMBC's College of Engineering and Information Technology (COEIT) offers six undergraduate degrees: a BS in Information Systems (IS), a BA in Business Technology Administration (BTA), a BS in Computer Science (CMSC), a BS in Computer Engineering (CMPE), a BS in Mechanical Engineering (ME) and a BS in Chemical, Biochemical, and Environmental Engineering (CBEE). COEIT accounts for a significant percentage of UMBC undergraduates, with 3487 students in the Fall 2016. This group is fairly computing heavy, with a total of 2424 in the four computing majors. In all COEIT undergraduate programs, women are a minority of students, ranging from 16% in computer science to 37% in chemical, biochemical and environmental engineering in the 2016-2017 academic year. In most programs, the percentage of women has increased slowly over the last several years.

CWIT was founded in 1998 as an online resource for research and resources about women and technology, including a focus on global issues in technology access for women. The CWIT Scholars Program was introduced in 2001. The first few cohorts were limited to students in computing majors, with engineering majors added in 2006. In 2008, the CWIT mission was revised to focus more firmly on improving the success of women in technology at UMBC. An Affiliates program for other COEIT students interested in the CWIT mission was launched in 2009 to increase the reach of CWIT on campus beyond Scholars, while global and business programs were phased out. The current mission of CWIT is to increase the diversity of those who will create technology through initiatives on campus and in our community.

We have identified four goals key to this aspiration: 1) sustain and strengthen vital Scholar programs for undergraduates committed to increasing the representation of women in computing and engineering fields, 2) work with allies to foster a supportive community for all women in computing and engineering at UMBC 3) improve climate for diversity in COEIT, and 4) broaden the pipeline of talented women interested in computing with K-12 outreach programs. This paper will concentrate on the Scholars Programs, more specifically on the CWIT Scholars Program.

4 PROGRAM MODEL

The Scholars programs within CWIT are at the core of all CWIT initiatives, with Scholars acting as peer-leaders for other program elements. Scholars participate in a series of academic and extracurricular activities designed to foster a supportive community for women and underrepresented minorities within computing and engineering. Our goal is to support Scholars academically and socially, by creating an environment that aids them in their technical pursuits. CWIT prepares Scholars to be leaders and advocates in their academic and professional fields, either by pursuing industry leadership as entrepreneurs, technical leads, or technical management, or by advancing to doctoral programs and an academic career. Both paths require strong academic performance and mastery of professional and leadership skills.

4.1 Scholar Selection

The CWIT Scholars Program is open to high-achieving students who enter COEIT majors as freshmen. Potential Scholars apply to the program in January of their senior year of high school. Scholar Selection is made on four equally weighted categories: 1) strong interest in computing and/or engineering field, 2) academic ability to succeed in the major, 3) drive to contribute through leadership within CWIT and UMBC communities, and 4) passion for increasing diversity in computing and engineering fields. The most promising applicants are invited to campus for an interview with faculty, current Scholars, CWIT alumni, and other industry professionals.

In addition to transcripts for course selection and grades, the selection committee also reviews essays, recommendation letters, and interview answers to glean clearer insight into a student's unique academic, cultural, and leadership background. While most of those selected to be Scholars have exceptionally strong academic backgrounds, the committee also selects some Scholars with strong potential but less clearly strong academic backgrounds.

4.2 Scholar Program Elements

CWIT Scholar Program elements have been intentionally introduced and refined over the years. Each program element has specific learning objectives and regular assessment. According to NCWIT [7], successful strategies for reforming undergraduate computing include implementing a recruiting plan for creating a pipeline of diverse students with appropriate competencies, helping students understand how their classes and internship or research experiences support their future identities as computing professionals, aligning assignments and coursework with students' goals and interests, and fostering a positive student-to-student and student-to-faculty environment with meaningful interactions contributing to their sense of belonging.

4.2.1 Community-building Events. The creation of a strong and supportive community is perhaps the most important element of the CWIT Scholars model. Community-building activities help build connections on all levels within the community, strengthening Scholars' ability to overcome possible academic challenges and creating an atmosphere where Scholars support one another. Additionally, a strong sense of belonging to a community of successful women can help protect against the vulnerability that can result from stereotype threat [6]. Specific community-building activities include a summer retreat to jump-start connections and skills, monthly program or cohort meetings, receptions to celebrate major events, and periodic social events.

The New Scholar Retreat is a three-day on-campus residential retreat for all incoming first-year Scholars. The Retreat includes sessions about transitioning to college, gender issues in technology, diversity, networking, campus resources, team-building, and opportunities to meet College faculty. A planning committee of returning Scholars designs and presents several of the sessions and attends the Retreat as resident peer mentors. There are three concrete benefits to having peer planners and presenters compared with staff presented sessions: a closer alignment with the interests and concerns of incoming Scholars, the greater persuasive power of peers, and the opportunity for leadership experience.

Cohort meetings provide opportunities for students with similar issues to receive targeted advice and share experiences and strategies. Stage-based cohorts give students at the same academic stage an opportunity to discuss academic challenges and transitions, job searching, or decision points. Major-based cohorts give students in the same major the chance to share discipline-specific strategies. The Allies in CWIT cohort gives men, gender non-conforming, and other CWIT allies in the community an opportunity to discuss strategies for becoming effective allies and advocates for diversity.

4.2.2 Living- Learning Community. The CWIT Living-Learning Community (LLC) complements other elements of the Scholar program by strengthening community ties, providing proximity for effective peer-mentoring opportunities, enabling easy access to students in the same classes, and providing an opportunity for residential leadership. All CWIT Scholars are required to live in the CWIT LLC during their first year and can apply to return for their sophomore year. After their sophomore year, Scholars tend to move to university-owned apartments, often with others from the LLC. The LLC is typically one third first-year Scholars, one third returning sophomores and one third CWIT Affiliates. Men supportive of the CWIT mission are welcome on the LLC, but women constitute a strong majority of floor residents. Students wishing to return to the CWIT LLC as sophomores must participate in one of three Engagement Teams: 1) Academic Team, focused on programming for academic success, 2) Social Team, focused on programming for community building 3) Retriever Connection, focused on connecting students to the larger UMBC community. The presence of sophomores on the floor provides convenient role models for first-year students and the structure of the Engagement Teams provides leadership opportunities for sophomores.

4.2.3 Academic Support. Academic support concentrates on the development of specific academic skills and coaching in academic strategies. A major academic initiative is a one-credit first-year course in fall of the freshman year. This course includes sessions led by upperclass Scholars on topics ranging from academic strategies and time management to networking and oral presentation skills. Other specific academic activities include mandatory study groups for STEM courses for underclassmen, workshops for selecting classes, and programming to strengthen academic skills such as test-taking, technical reading, communicating with professors, and time management. Scholars are encouraged to give back academically by serving as a resource for study groups, providing tutoring, serving as undergraduate teaching assistants, and working in departmental help centers.

Another major component of the CWIT Scholar experience is monthly one-on-one meetings with the CWIT staff. At the beginning of each semester, Scholars set goals for themselves, which are revisited every month to track progress. Overall goals for the meetings are that students will self-reflect on their academic past and present academic performance, communicate academic challenges or barriers hindering their success at maintaining the required GPA, understand the importance of seeking help when needed, better understand CWIT and UMBC resources, and display a willingness to effectively utilize suggested strategies for improvement. These meetings allow Scholars to develop a meaningful relationship with a staff member who can serve as a support system and an early alert system for academic struggles.

4.2.4 Mentoring Programs. Mentoring activities include a peer-mentoring program in which first-year Scholars are paired with an older Scholar in their academic major, a pairing with a faculty mentor during their first year, an industry mentoring practicum and match with an industry mentor during their junior year, and informal meetings with distinguished visitors to campus. The industry mentoring practicum includes face-to-face connections with industry mentors as well as sessions dedicated to helping the Scholars develop their professional identities and understand the career or graduate school process. Scholars are encouraged to meet monthly with their industry mentor for personalized discussions. Small groups of industry mentors join each class session, giving Scholars a chance to get to know the mentors of other Scholars and mentors to get to know one another. These multiple forms of interaction help build deeper bonds and a richer mentoring experience for all involved. CWIT also encourages research experiences for

Scholars by partnering with campus initiatives supporting undergraduate research.

4.2.5 Leadership Development. Leadership training addresses the need for soft skills to complement academic performance. Important complementary skills include public speaking, networking, project planning and execution, working with a team, advocacy, and workforce preparation. This programming draws on the expertise of CWIT alumni, the UMBC Career and Shriver Centers, and partners in local companies. A foundation for leadership is laid with a leadership practicum in the spring of the sophomore year. Scholars are encouraged to practice leadership skills by speaking on panels, becoming active in technical and professional organizations, serving as student representatives on department committees, and participating in student government and activism. In order to provide additional leadership practice, large-scale CWIT networking and outreach events are typically organized by a student planning team working in conjunction with CWIT staff.

5 EFFECTIVENESS OF THE MODEL

Since 2002, the CWIT Scholars program has served 174 students; 86% of CWIT Scholars identified as women and 12% were from underrepresented racial-ethnic minority backgrounds. Historically, CWIT Scholars have a 91.7% retention rate in computing and engineering majors, an overall 87.6% graduation rate, and an average time to degree of 4.2 years. Our primary goal is to increase the academic performance, retention, and graduation of CWIT Scholars relative to the overall COEIT undergraduate population; thus, we evaluate the performance of the CWIT Scholars in comparison to their peers with similar incoming profiles.

5.1 Methodology

Using anonymized institutional data from UMBC cohorts entering COEIT from Fall 2002 to Fall 2012 (N=6,681), we employed a case-control matching procedure in SPSS Statistics software (version 24) to draw a matched sample and assess differences in academic outcomes between CWIT Scholars and non-CWIT Scholars. A sample of CWIT Scholar cases was matched to non-CWIT Scholar cases on gender (male/female), race-ethnicity (underrepresented minority / non-underrepresented minority), UMBC cohort, incoming COEIT major, math SAT score, and high school GPA. Match tolerance levels were set at .3 for high school GPA and 50 for math SAT score. These parameters yielded a sample of 134 cases; 67 matches representing 56% of the 120 CWIT Scholars who entered as freshman between Fall 2002 and Fall 2012).

Descriptive statistics and histograms of the total 134 cases were run to examine the distribution and normalcy of the data. Independent samples t-tests and Mann Whitney U tests were run to confirm that the CWIT Scholar cases and non-CWIT Scholar cases did not differ significantly on the matching variables (pre-UMBC characteristics) and to examine any significant differences on academic outcomes. The outcome variables assessed were average cumulative GPA, average years to degree, graduation from UMBC, graduation within four years, graduation within five years, graduation within six years, and retention in a computing or engineering major.

Table 1: CWIT Scholars compared the non-CWIT Scholars entering UMBC Fall 2002 to Fall 2012. Bold rows show statistically significant differences.

Academic Outcomes	CWIT Scholars	Non-CWIT Scholars
Average years to degree	4.26	4.33
Last reported cum. GPA	3.30	3.11
Overall graduation rate	82.1%	71.6%
Four-year graduation rate	**61.2%**	**41.8%**
Five-year graduation rate	79.1%	64.2%
Six-year graduation rate	79.1%	70.2%
Retention rate in COEIT	**86.6%**	**71.6%**

5.2 Results

Comparisons of academic outcomes among CWIT Scholars and non-CWIT Scholars indicate that the CWIT Scholar program model is meeting its intended goals. Compared to matched peers with similar profiles, CWIT Scholars have higher cumulative GPAs and UMBC graduation rates, and shorter time to degree. Additionally, Mann Whitney U tests indicated that there was a statistically significant difference in the number of CWIT Scholars graduating within four years (41) compared to the number of non-CWIT Scholars graduating within four years (28); $z = -2.239$, $p = .025$. There was also a statistically significant difference in the number of CWIT Scholars retained in a COEIT major (58) compared to the number of non-CWIT Scholars retained in a COEIT major (48); $z = -2.117$, $p = .034$. Additional differences on academic outcomes were observed, though not statistically significant at the .05 level. A summary of the group differences between sampled CWIT Scholars and non-CWIT Scholar peers is presented in Table 1.

6 ADAPTING THE MODEL

The CWIT Scholars model includes elements that have been successfully adapted to serve other student populations. The following are two examples of how the CWIT Scholars model was adapted to create 1) a transfer Scholar program (T-SITE) and 2) a CWIT Affiliates program. We also provide tips for implementing aspects of the CWIT Scholars program at other institutions and describe some of the challenges organizers might face during the planning and implementation process.

6.1 T-SITE Scholar Program

The T-SITE (Transfer Scholars in Information Technology and Engineering) program applies the structure and community focus of the CWIT Scholar model to high-achieving transfer students with financial need to increase their success in computing and engineering majors. As with CWIT Scholars, we provide T-SITE Scholars with academic and professional development opportunities, including connections to internships and research experiences.

Since its inception in 2012, the T-SITE program has served 32 transfer students with diverse backgrounds from Maryland community colleges who are majoring in engineering or computing and have demonstrated financial need. Forty-seven percent of these

scholars identify as women, and 50% identify as an underrepresented racial-ethnic minority. Scholars in the first five cohorts entered UMBC with an average transfer GPA of 3.55 and 65 credits completed. The average time to graduation for T-SITE Scholars is three years after transferring to UMBC. One hundred percent of all students in the first five T-SITE cohorts have been retained in engineering or computing majors.

Demographically, T-SITE Scholars have different characteristics than incoming freshman. They tend to be older, with different responsibilities and motivations than first-time freshmen. Most have worked full-time while attending community college and may have spouses and/or children. Although transfer students have completed many courses at community college, they may not have strategically planned courses that will lead to completion of a four-year degree. The psychological and emotional aspects of transferring from a community college to a four-year institution pose challenges not generally experienced by typical incoming freshmen. The CWIT model of support safeguards the transition process and nurtures the development of T-SITE Scholars as successful UMBC students and future professionals in engineering and computing.

6.2 Affiliates Program

We have adapted elements of the CWIT Scholar experience to increase our reach within the College. The CWIT Affiliates program was created to offer a strong sense of community and connection among the approximately 600 women in COEIT. It includes a peer mentoring program, the first-year experience course, networking events, social events, and workshops focused on topics ranging from academic success strategies to career skills and issues for women in technology. Additionally, incoming freshmen can apply to the CWIT LLC. The Affiliates program is designed to leverage the CWIT infrastructure and community to offer connections and resources to students without the need for individualized attention from staff.

Affiliates who live in the CWIT LLC are provided with additional academic advising from the CWIT staff to place both Scholars and Affiliates in the same course sections. This allows for increased peer support and easy development of study groups throughout the semester. Not only are Affiliates active participants in programs provided by CWIT staff but they are also leaders within the community by serving as CWIT peer mentors, CWIT Student Council members, CWIT office student assistants, and coordinators of CWIT Affiliate retreats and workshops.

The CWIT Affiliates Workshop series leverages the expertise of faculty and staff who work within COEIT, Residential Life, and Academic Affairs Offices. The bi-weekly workshop topics include diversity issues in technology, imposter syndrome exercises, decreasing test anxiety, leadership styles in computing fields, applying to graduate school, the STEM pipeline and ways to give back, microaggression in the classroom, and digital image curation.

The primary challenge of the Affiliates program is keeping students engaged in the face of many competing demands for their time. We conduct end-of-year surveys of Affiliates and solicit advice from an Affiliates advisory board to ensure that our programming continues to be relevant and valuable to busy students. In 2016-2017, approximately 190 students were identified as Affiliates.

6.3 Adapting for Other Institutions

The CWIT Scholars Program is a model with elements that can easily be adapted by universities seeking to support women in engineering and computing. While the CWIT Scholars Program does offer scholarship support, this is not necessary to replicate many of the initiatives. The following are best practices, resources, and potential challenges for implementation.

Peer Mentoring. The peer mentoring program can be offered to first-year students (freshmen and transfer) as a way of connecting them to a more experienced student in their major. This can be done through both formal and informal gatherings. Time and effort in executing this program mostly occurs at the beginning of the year. Once in place, monthly emails about ways to continue the relationship don't require extensive time. The challenges to consider are creating an application that provides enough information for the organizer to make a positive match for mentor and protégé. With additional financial and time resources, a peer mentor program can include more events and giveaways that foster a close relationship.

Faculty Mentoring. Pairing incoming students with a passionate and engaged faculty mentor is a great way to establish university norms, academic goals, and create positive faculty and student relationships. A large challenge to this program for many institutions is the time commitment faced by many faculty members, but by using a similar process as the Peer Mentoring program, matches can be made within students' intended majors.

Industry Mentor Program. The industry mentoring program can be offered with either in person mentors or by leveraging an online mentoring program (such as mentornet.org or another). Whether students are meeting with their mentors in person or virtually, they can come together regularly to share what they've learned from their experiences with industry mentors. The benefit of this is twofold, 1) students are able to connect with one another and 2) students are able to hear multiple perspectives from industry professionals. Organizers can build upon the existing relationships that the Career Center and Alumni Relations have with individuals in the computing and engineering fields. The challenges that this program faces are 1) lack of pre existing industry relationships, 2) time and commitment ability for mentors, and 3) providing consistent experiences for all mentors and protégés.

First-Year Experience Course. The first-year experience course can also be adapted to become individual workshops or be offered as a full one-credit course as it is within CWIT. Potential topics for a first-year experience course are limitless and can be easily adapted to fit any university. Several institutions have a version of a first-year experience course where a few sections could be tailored for women in computing and engineering majors to provide the instructor with the opportunity to focus general topics on specific ways women can succeed in these majors. Additionally, students can collaborate with one another in selecting future courses, allowing for increased female representation in specific sections and creating study groups together. Alternatively, for universities without a first-year experience course, these could become topical workshops advertised to students in ITE majors and conducted on a bi-weekly or monthly basis. Key challenges to adding anything to an already

packed curriculum is the impact of an additional one-credit course, deciding whether it is mandatory for students, and finding the financial support to pay instructors and program expenses.

Living-Learning Communities (LLC). Women who are interested in computing and engineering majors and living on campus can greatly benefit from being placed together on a floor with programming related to success in their major. Not only does this increase the ability for students to study similar subjects together, but they are surrounded by other women who are passionate about these fields. Challenges for implementing an LLC for women in technology include space limitations within residential life, having the ability to train a student resident assistant in issues related to women in technology, and monetary resources.

Summer Community Retreat. A one to three day community retreat for interested new students can review topics such as diversity in technology, team building, identity development, brave space guidelines, networking and professional development, what to expect when moving to campus, allies in action, and academic resources. Each topic area is covered with the goal of increasing knowledge and success in computing and engineering majors. The challenge with providing retreats are financial resources and limitations of the time to deeply discuss several topics. If possible, a three-day on campus retreat provides students with additional social experiences and community building experiences that gives them a jumpstart to the academic year and knowing more people. This will decrease anxiety as they start their first semester.

Affiliates Workshop Series. This program is a great way to utilize the experts at individual institutions. After identifying a consistent day of the week, time, and location, organizers can contact faculty and staff regarding topics related to increasing the success of women in computing and engineering. The challenges in running a successful workshop series is having consistent attendance, reaching your target market through advertising, and cultivating the relationships with the experts at the specific institution.

7 LIMITATIONS

There are external and internal limitations to the successful increase of women in computing and engineering fields. The dominant culture and lack of representation of women in computing and engineering fields in the media impact the K-12 pipeline to higher education and advanced degrees. The ability to provide extended programs to the hundreds of women currently studying COEIT majors is constrained by resources, both availability of funds and limited staff. The Scholar model described here requires substantial resources for a lean public university, with limited staff resources being harder to overcome than limited program support funds. Scholarships increase interest in programs and give staff leverage to mandate participation in activities. Without the scholarship component (as in the Affiliates model described here), staff must work much harder to convince busy students to participate.

A possible critique of the CWIT Scholars program is that most Scholars are academically high achieving and would succeed without the interventions of the program. While high achieving women may complete these majors with or without interventions, challenges such as microaggressions, imposter syndrome, lack of confidence, and others are inevitably part of their experience. We show better outcomes for Scholars, even among these high-performing women. When we only focus on graduation numbers as the outcome, we neglect to consider that women who complete these majors may have had a negative experience that may have lasting impact as they enter the workforce or graduate school. The CWIT Scholars program works to minimize and educate students about these intangible barriers and support them so they have a more positive experience throughout their undergraduate years thus more likely to continue pursuing their professional and academic goals.

8 CONCLUSIONS

The CWIT Scholar program model is an effective model for increasing the retention and success of women in undergraduate computing and engineering majors. The core of this model is the development of a strong, welcoming, and multi-faceted community that can provide academic and professional resources to help women feel connected to others in their discipline, and support women through times of doubt or difficulty. Scholars have overcome stereotype threat by building community among women in computing and engineering fields at UMBC. This model has been successfully adapted to other Scholar programs at UMBC and has elements that could be adopted at other universities.

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