



Women Advancing in Technology

Dr. Evelyn R. Sowell, North Carolina A&T State University

Dr. Evelyn R. Sowell earned a Ph.D. in Electrical Engineering from North Carolina A&T State University's College of Engineering. She also holds a M.S. and B.S in Computer Science with a concentration in software engineering from the same university. Her primary research interests are in the areas of low-power high performance digital systems design, asynchronous design, self-timed digital system design and STEM education. As a result of her work, she has numerous peer reviewed journal and conference publications. Evelyn is not only outstanding in teaching and research, but also in service. She recently received the 2013 Chair's Award for Outstanding Service in the Department of Computer System Technology.

Ms. Nina Exner, North Carolina Agricultural & Technical State University

Nina Exner is a research librarian at North Carolina Agricultural & Technical State University and a doctoral pre-candidate in information science at UNC-CH. Her research and publishing history centers around researcher emergence, practitioner-researcher information needs, and mentoring.

Dr. Sherry F Abernathy

Dr. Rajeev K Agrawal, North Carolina A&T State University

Dr. Rajeev Agrawal has been teaching in the Department of Computer Systems Technology at North Carolina Agricultural and Technical State University (NCAT), Greensboro, North Carolina for last five years. His current research focuses on Big data Analytics, Cloud Computing, and Content-based Image Retrieval. He received the best paper award for his paper on Image Clustering Using Multimodal Keywords in the International Conference on Semantics and Digital Media Technology, Athens, Greece. He has published more than 40 referred journal and conference papers and 4 book chapters. He has been project manager and a member of several research and industrial grants. Dr. Agrawal actively serves as committee member and reviewer for conferences and journals in his area of research. He is a member of ACM, ASEE and IEEE.

Brenda S. Faison Ph.D., North Carolina A&T State University

Biography: Brenda S. Faison, Ph.D. Born in North Carolina, Dr. Brenda S. Faison is Chief Creative Officer of Brenda Faison and Associates, LLC; and iDesignbase, LLC. She studied Visual Communication in North Carolina Central University's Department of Art in Durham, receiving her B.A. degree in 1980. She obtained her master's degree in 1984 from North Carolina State University's College of Design at Raleigh, focusing in the area of Visual Design. In 1995, she earned her Ph.D. focusing in Computer Graphics in the Arts and Design, studying at the Advanced Computing Center for the Arts and Design (ACCAD), through the Department of Art Education at The Ohio State University at Columbus.

Dr. Faison views design as a purposeful, systematic, and creative activity saying, "design is purposeful in that designers give form to products and visual communications, and satisfy the functional, psychological, and aesthetic needs of end users. It is systematic, in that it involves the analysis of problems in our physical environment, and the transformation of findings into appropriate and usable solutions. Design is also creative, in that designers must have the expertise to create compelling visual forms for products, spaces, and new media—and to advance the evolution of new technologies in the design."

Within the design profession, Dr. Faison worked as an Associate Graphic Designer for several years with IBM Corporation in Research Triangle Park, North Carolina; and Manassas, Virginia. She started her own design firm, Designbase Associates, Inc., which she operated for seven years near Research Triangle Park, NC, before returning to doctoral studies. Among her clients at Designbase were companies such as GTE, GlaxoSmithCline, IBM Corporation, NorTel, U.S. Army Research Office, and Duke University, to name a few. The firm also designed, and produced a series of art and social commentary posters, which were marketed to individuals, schools, corporations, and military bases, as well as state and federal agencies.



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In 1991, Dr. Faison, wrote, designed, produced and marketed an AIDS prevention publication entitled *The AIDS Handbook: A Complete Guide to Education and Awareness*, which was edited by Dr. Laila Mustafa of the World Health Organization. This handbook received favorable reviews from *The Library Journal*, *Radio Free Europe/Radio Liberty*, *E.I. Du Pont De Nemours & Company*, etc. It was successfully marketed to corporate employee assistance programs, libraries, individuals, wholesalers and distributors. She also wrote the book, *New Media Careers for Artists and Designers* in 2003. In 2007, Dr. Faison was presented the Exemplary Teaching and Service Award by North Carolina Central University's College of Liberal Studies. She has taught graphic design and new media at universities in Ohio, Georgia, Virginia, and North Carolina, and has seven years of academic management experience in higher education.

The Recruit-Support-Connect Program: Women Advancing in Technology

Abstract

The Recruit-Support-Connect program is an initiative that brought several diversity programs together at The School of Technology (SoT) of North Carolina Agricultural and Technical State University (NC A&T State University) to successfully support female recruitment into technology majors. NC A&T State University is a Historically Black College and University with a STEM Early College High School located on campus. NC A&T State University as a whole has a 54 percent female undergraduate student body, but in the School of Technology only 25 percent of our students were female. This past challenge gave us a unique position to capitalize on the opportunity to make a paradigm shift to be more reflective of the nation's population. Although the focus of this program was originally to advance the participation of underrepresented populations in the STEM fields, the RSC program had its greatest impact on female students. This initial difference in the impact allowed us to increase targeted mentoring and role-modelling programs for even greater female-centered recruitment. Since 2011, the female enrollment rate in the School of Technology has increased 22 percent. The first to second year retention rate for all SoT students increased 10 percent. The preliminary data suggest that if these numbers continue to increase, the SoT should see an increase in graduation rates for the 2015 graduation class. We have already seen modest increase in graduation rates, 9 percent since the inception of the RSC program. As the program moves forward we have increased the number of female-focused elements in this program, and found mentoring, peer communities, awareness-building, and sense of connection to be key factors for female student support.

Introduction

Increasing the pool of qualified workers, particularly more women and underrepresented minorities (URM), in the Science, Technology, Engineering, and Mathematics (STEM) areas has become one of the nation's key priorities, as those professions are the backbone of innovation and critical to our country's economic future^{1,2}. According to the US Bureau of Labor Statistics, only 6 percent of U.S. workers are employed in the STEM fields, and they are responsible for more than half of our sustained economic expansion³. Statistics have also shown that over the last decade, STEM jobs grew three times faster than non-STEM positions³. The demand for STEM professions is projected to continue climbing in the next 10 years. However, recruiting for skilled people poses a challenge for many companies, with an even greater one for minority candidates⁴. A recent study by Gibbons, "Engineering by the Numbers," found that women only earned 18.4 percent of engineering degrees in the U.S. awarded in 2010⁵, even though women make up 51 percent of the population. This discrepancy is unacceptable, and it makes us rethink the way we approach the development of future workers' skills. Inclusiveness initiatives are critical issues in higher education⁶, and

diversity is an essential quality in technology team success⁷. Recognizing the need for greater numbers of minorities, particularly women, to pursue degrees in STEM disciplines, NC A&T State University's School of Technology launched a strategic initiative for programs funded by American Society of Engineering Education and sponsored by companies from our industry advisory board. This initiative brought several programs together to work in tandem to improve mentorship, recruitment, retention, and job placement for these underserve populations. When coordinated, this created a pipeline that moves students from high school, to undergraduate school, then to the workforce. We call this threefold strategic initiative the Recruit-Support- Connect (RSC) program.

To address the national pressing need for a diverse STEM workforce, the RSC initiative was created to increase enrollment, retention, and degrees awarded to female students from 2011 – 2013 in the School of Technology. NC A&T State University's School of Technology covers a variety of fields such as Applied Engineering Technology, Construction Management, Electronics Technology, Environmental Health and Safety, Geomatics, Graphic Communication Systems, Information Technology, and Motorsports Technology. The RSC goal was to expose female students to these varied programs and show the students how interesting and valuable a technology degree could be for them. The RSC initiative took existing programs for student engagement, and added female-focused enrichment experiences for high school students and undergraduate students at the university. It built upon a core of existing successes such as Extreme IT Day and Technology Week. In Extreme IT Day, over 350 high school students come from all over the state for a career fair, workshops and info session led by company representative from our industry advisory board. Technology Week is a school-wide effort that showcases our latest graduate and undergraduate research. To increase the female focus, the RSC program added a Woman in Technology Symposium where top-level female executive panel members mentored and advised female students from the university and visited the local STEM high school for girls. The Women in Technology Symposium also featured female student researchers who gave oral poster presentations. In addition, to keep students involved and motivated in the technology field, a series of workshops, mentoring, and professional development seminars were incorporated for ongoing student engagement.

Background: The need to improve diversity in STEM

During the last several decades, there has been a growing public consensus that it is vital to prepare a qualified STEM workforce that will generate a profound impact on the nation's economy and prosperity¹. Even though the total percentage of undergraduate students pursuing STEM degrees in the U.S. has moderately increased over the past ten years, when U.S. STEM achievement is compared to other nations like China, the numbers are woefully low⁸. The number becomes even more alarming if we consider underserved populations like minority females⁹. The question then becomes, how can we change this growing trend?

According to “Custodial Mothers and Fathers and Their Child Support”, a report released by the U.S. Census Bureau, the household composition has change over the past 20 years ¹⁰. There has been a continuous increase in single parent homes, approximately 13.7 million in the U.S. alone of which 82 percent of the custodial parents are women; of this number, 76 percent of the single mothers are gainfully employed versus 85 percent for single fathers ¹⁰. When we consider the standard of living for these households, single mothers and their children are twice as likely to live in poverty as the general population. Low income students typically come from non-college- educated families and are potentially first-generation college students from families where neither parent had more than a high-school education¹¹. These students tend to face a number of challenges, such as poor academic preparation in high school, inadequate finances, deficient educational degree expectations and plans, a lack of appropriate role models or mentors, and a lack of support from peers or family members¹². For low income households, college education represents a route out of poverty; however, low income students increasingly are matched with under-supportive and low-quality educational opportunities or no educational opportunities at all¹³. If this trend continues, we will see more of an economic divide between the poor and the middle class in America.

A report from the Georgetown University Center on Education on the STEM career workforce shows that 65 percent of bachelor’s degrees in STEM occupations earn more than master’s degrees in non-STEM occupations ¹⁴. Similarly, 47 percent of bachelor’s degrees in STEM occupations earn more than PhDs in non-STEM occupations ¹⁴. Furthermore, even people with only STEM certificates can earn more than people with non-STEM degrees; for instance, certificate holders in engineering earn more than associate’s degree holders in business and more than bachelor’s degree holders in education ¹⁴. The RSC program was created to harness this STEM economic value in order to strengthen the pipeline of females who enter technology careers and offset this disturbing economic paradigm shift in U.S. households led by single mothers.

Context: NC A&T State University’s School of Technology

Our University recognizes the critical importance of increasing the pipeline of females in the STEM majors. The Recruit-Support-Connect (RSC) program is focused on recruiting and mentoring female students to pursue careers in STEM generally and particularly in technology. The objective of RSC is to increase the number of female students who pursue degrees in technology disciplines on the collegiate level and who are prepared for a technologically-rich workforce. More specifically, the goal is to increase the number of female students who graduate with a technology degree (in Applied Engineering Technology, Information Technology, Construction Management, Electronics Technology, Geomatics, Graphics Communication Systems, Motorsports Technology, and Occupational Safety and Health). Table 1 illustrates the demographics of our research focus.

NC A&T State University has a long record as the leading producer of African American baccalaureate engineers and technical professionals, which made it the prime candidate to be the

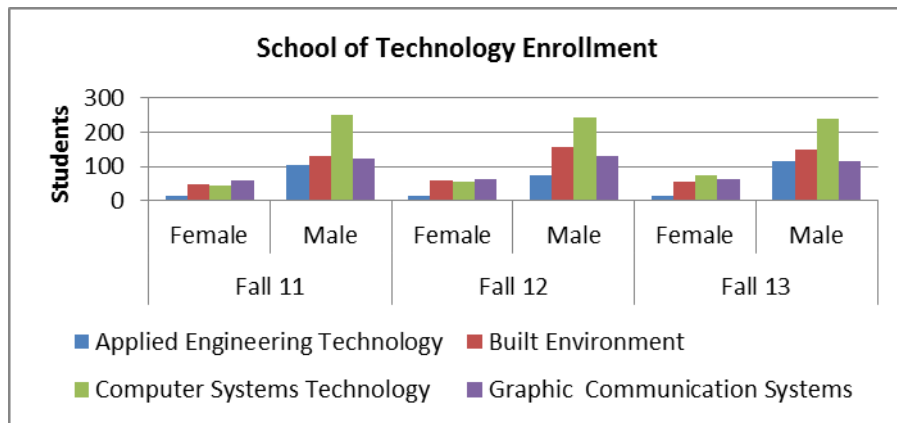
focal point of the RSC program. The university is a fully accredited and has departments including Computer Systems Technology, Built Environment, Graphic Communication Systems, and Applied Engineering Technology. The School of Technology offers

Table 1: Race and Gender make up of SoT Students

Department	Race	Year															
		Fall06		Fall07		Fall08		Fall09		Fall10		Fall11		Fall12		Fall13	
		F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
Applied Engineering Technology	Black	28	77	24	84	22	97	31	88	26	77	15	83	10	64	4	95
	White	1	18	3	12	2	11	0	11	2	17	1	13	2	6	9	9
	Other	1	5	2	7	1	5	2	5	0	3	0	8	1	5	1	12
Built Environment	Black	34	82	36	67	33	86	27	98	37	106	38	84	43	111	44	103
	White	5	30	2	24	2	28	2	30	4	23	5	35	7	26	12	32
	Other	4	8	2	8	4	6	3	5	2	8	5	13	8	20	1	15
Computer Systems Technology	Black	81	297	69	244	72	264	60	252	48	227	40	221	43	208	65	203
	White	3	17	2	17	0	19	0	14	2	10	2	9	5	12	4	18
	Other	2	9	3	7	3	7	1	14	4	15	4	22	7	23	5	19
Graphic Communication Systems	Black	97	183	95	173	91	150	81	127	65	113	55	104	57	113	58	104
	White	12	10	8	12	6	19	7	19	6	16	3	11	3	10	2	5
	Other	2	1	3	3	4	5	6	7	3	7	2	7	3	9	3	7
School of Technology	Black	240	639	224	568	218	597	199	565	176	523	148	492	153	496	171	508
	White	21	75	15	65	10	77	9	74	14	66	11	68	17	54	27	64
	Other	9	23	10	25	12	23	12	31	9	33	10	50	19	57	9	53
Total Number of Student		270	737	249	658	240	697	220	670	199	622	169	610	189	607	207	625

undergraduate and graduate degrees, educating over 800 students annually (see table 1). Over 85 percent of the School of Technology student population is African American. The total enrollment since 2006 in the School of Technology shows a drop from 1007 to 832.

Figure 1: Student Enrollment in SoT



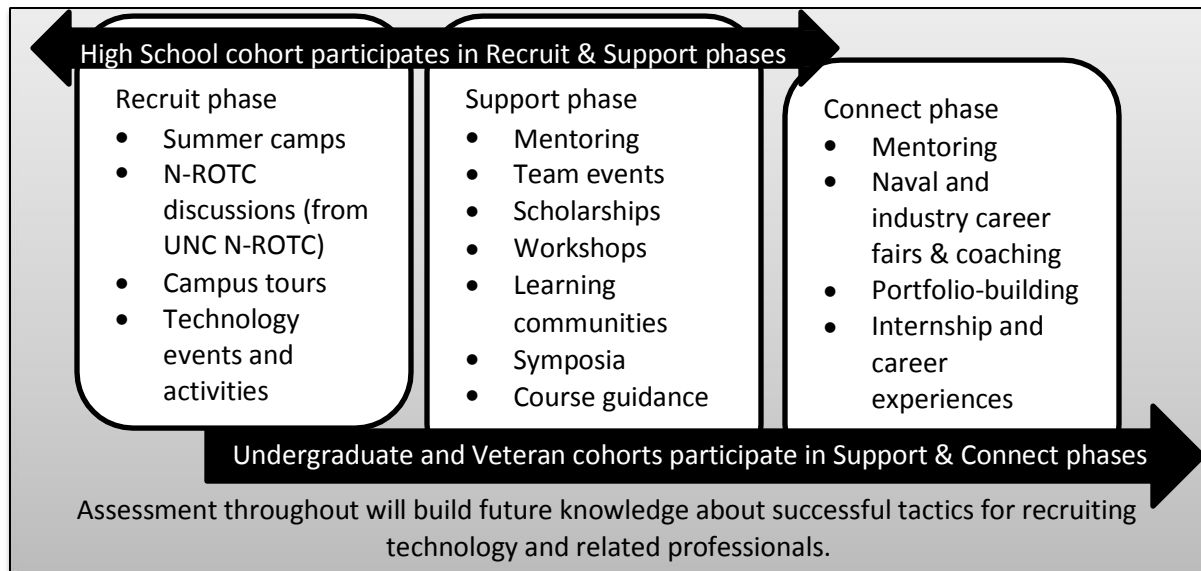
The school began to see a decrease in enrollment in fall 2011. Most significant was the 16

percent drop in female enrollment as opposed to 2 percent decrease for their male counterparts. The school's female enrollment was also down more than 37 percent since 2006 (a drop from 270 to 169). In 2011, the school aimed to increase the enrollment with RSC program and other more general initiatives. Admissions in the School of Technology for fall 2013 increased 32.5 percent from the previous year (120 admits as compared to 81 admits for fall 2012).

Program Description

This program increased STEM workplace diversity through a pipeline program with a strategic initiative to increase the numbers and successes of our female (especially female minority) technology majors. The pipeline strategy arranged for several programs to work in tandem to improve mentoring, recruitment, retention, and job placement for underserved populations. When coordinated, the initiative creates a portal that transitions students from high school, to undergraduate school, then to the workforce. We call this threefold strategic initiative program Recruit, Support and Connect (RSC).

Figure 2: Recruit, Support and Connect Program Phases



Recruit-Support-Connect is a pipeline with three stages: 1) it recruits female high school students into technology programs and STEM in general, 2) it supports female students through the collegiate process with living-learning communities, workshops, community-building activities, mentoring, etc. to support and retain them in the program and, 3) it connects them to jobs through targeted job placement facilitated by an advisory board that will help match students with companies and build their electronic portfolios for marketability. Figure 2 illustrates the RSC program phases. Summer recruitment camps, living-learning communities,

advanced symposia, and other techniques used in the Recruit-Support-Connect pipeline have proven to be effective with our students. Since 2011, we have experienced increasing enrollment, retention, and graduation rates in the School of Technology. However, these increases are largest in the female student population. We connected proven strategies for a holistic experience throughout the pipeline phases. This collective design builds on effective components to reinforce winning concepts and increase success rates for improving diversity in STEM fields.

The RSC pipeline is based on a strengths-based model approach. Strengths-based models are educational intervention methods which focus on enhancing the existing strengths of a student and upon these strengths as opposed to focusing on remediating deficiencies^{15, 16}. The four factors embodied by a strengths-based approach are: (1) Academic and Social Integration, (2) Knowledge and Skills Development, (3) Support and Motivation and (4) Monitoring and Advising. This model has been proven to effectively enhance minority participation in the sciences, math, and medical careers in programs such as the Meyerhoff Scholars Program at the University of Maryland Baltimore County which was initially designed to increase the number of minorities pursuing PhDs in medicine and the sciences^{15, 16}. This program takes students interested in STEM doctorates and supports them through postgraduate completion^{15, 16}. The Meyerhoff Scholars Program is nationally recognized and numerous articles have been published focusing on the success of the program. Between 2000- 2003, over 50 percent of the initial Meyerhoff Scholars cohorts, which began in 1989-1992, entered graduate PhD programs. This represents a 5 times greater percentage increase compared to students without the Meyerhoff strength-bases intervention at UMBC^{15, 16}. Seeing how effective this program is, it provides an inspiring reason to attempt the strengths-based approach in other contexts.

Intellectual merits of this program were drawn from the established literature. The American Association of University Women has shown that pre-college recruitment is critical to build young women's involvement and confidence in technology, and also establishes the value of mentoring and a supportive environment for diverse women¹⁷. Recruitment through summer camps, interaction with STEM leaders, and outreach are proven to build confidence and experience in STEM and attract women and minorities into STEM fields of study^{18, 19}. Following those experiences with workshops, mentoring, and supportive environments like living-learning communities is an established strategy for supporting women through STEM in college^{20, 21, 22}. Supportive environments and guidance are also critical for degree completion and job placement at the end of and after college²³. All of these studies and others emphasize the value of mentors in terms of career and professional related attitude. This project combined all of these approaches into a full pipeline experience to ensure and study the success of participants.

What makes RSC unique? The RSC program pipeline utilizes the learning community of students with common interest in technology and combines it with a strength based model to

build upon best practices. RSC will be the first of its kind this university where students of these specific demographics will be given specialized mentoring and support to ensure their academic progression towards earning a Bachelor's degree in the Technology field. Components entering this strategy since 2011 are proven: the female enrollment rate has increased 22 percent. The first to second year retention rate for all SoT students has increased by 10 percent and graduation rates have increased by 9 percent. Proven strengths are fundamental to this program, which will build on and assess our successes.

Phase One: Recruit

The RSC program is based on a three-fold strategic implementation methodology where each stage in the pipeline is designed to achieve a particular outcome. Recruiting is the first segment of the **RSC** pipeline that effects a positive change to increase diversity in the technology profession. The first segment stimulates interest, recruits, and mentors high school female students.

A. Recruitment/Enrollment Management

A new position was created to increase and manage overall student enrollment in the School of Technology. Since the School of Technology and the university have strategic goals to improve diversity, many of the recruitment initiative are aimed to attract females. Recruitment initiatives are accomplished through partnerships with community colleges, high schools, and the internal and external University community. Listed are a few initiatives that were implemented this year to increase female enrollment:

- Counselors recommended 50 females students that were unsure of career plans from High Point Andrews and T. Wingate High School for a tour of the School of Technology, followed by an overview of our programs. We then had leading female students in their respective majors host a Q/A session. Our exit survey showed that the tour and overview stimulated interest in 51 percent of the females who had not been interested in Technology before arrival.
- The annual Women in Technology Day featured top female executives who served as our panel to discuss their success as Women in Technology followed by a Q&A session.
- Increased female presence and visibility on our advertisements and information sheets for perspective students.
- During events (campus events, college fairs, career fairs), we ensure that there are always female faculty, staff or students present to reinforce female visibility and leadership in technology and to answer any questions.

B. Females in Technology (FiT) Summer Boot Camp

The FiT Summer Boot Camp is a summer weekend residential technology boot camp funded by American Society of Engineering Education for low income rising high school juniors and senior girls to broaden participation in technology. As a recruitment

tool, the objective is to increasing the enrollment of female students in the school of technology which will ultimately have a positive effect on the number of technology degree earned by females. Not only does this program stimulate interest in the technology profession, it also introduces female students to new and innovative technology. This project was designed to advance education and equality for females.

C. Extreme IT Day

One of our largest recruitment tools is the Extreme Information Technology (IT) Day which is an annual event sponsored by the university. The Extreme IT Day event has been held since 2010. Since its inception, more than 1,400 high school students have attended Extreme IT Day. The mission of this event is to develop skills and promote career opportunities in mainframe technologies, integrated IT systems, and cloud computing technologies. The event brings together educators, industry partners, and approximately 400 highly motivated high school and college students annually from the southeastern United States for a day of fun and innovation. Industry partners help set goals and expectations for students and serve on our School of Technology Advisory Board. Clearly defining and measuring academic success has helped to create the path forward for our faculty and students.

Students participate in various hands-on, minds-on exercises designed to enhance applied STEM skills for managing enterprise systems. We target students who are interested in information technology from disciplines such as computer science, information systems, engineering, accounting/finance, and marketing. Corporate participants in past years have included: BB&T, John Deere, IBM, Cisco, Red Hat, Bank of America, Clear Blade, First Citizens Bank, Fidelity Investment, and Northrop Grumman, to name just a few sponsors.

High schools participating include students from Greensboro, Winston-Salem, High Point, Charlotte, Durham, and Eastern counties of North Carolina. Students from universities and community college attending in the afternoon travel from North Carolina and from other states including Georgia, South Carolina, and Virginia to attend this highly successful program. This is a one-day event, with the focus on high school students in the morning and college students in the afternoon. Start time is normally around 9 am with an end time for high school students at 1 pm. Lunch is provided for the high school students, participating faculty and active industry participants.

Students attending receive current information in many areas including mainframe technologies, integrated IT systems, and cloud computing technologies. Companies and businesses participating are interested in other IT related disciplines including business management, project management, workplace safety, and manufacturing processes that tie in with the technological competencies in demand at their individual business or industry. An active learning classroom model is used to facilitate small group learning experiences.

An interesting addition to Extreme IT Day has been the Career Expo afternoon session

where companies and organizations that use enterprise technology systems come to directly interact with the best and the brightest students from the university along with other talented students from regionally-participating colleges and universities. These organizations make presentations, conduct demonstrations, review resumes, interview students, and/or use their blocks of time in other dynamic ways that they find productive to identify and encourage the next group of enterprise systems superstars. The Career Expo is typically held from 1-5 pm. Typically 400+ students from regional high schools and local colleges attend this invitation only event. Since its inception, more than 1700 high school students have attended Extreme IT Day. Distinguished keynote speakers for Extreme IT Day have including the following:

- Chief Information Officer (CIO) for the State of North Carolina
- CTO, IBM
- General Manager, CA Technologies
- Deputy CIO, City of Atlanta, Georgia
- Director, IBM

The event is held in the Alumni-University Foundation Event Center located on the campus. This facility is equipped with the latest in lighting, audio visual components, and technical equipment and is uniquely suited to be the location of this event. There is ample parking on site with space for over 600 vehicles.

The university strives to educate students so they may effectively compete in the 21st century workforce. The success of Extreme IT Day is evidence that the university is meeting the technological demands of industry and enhancing student success. The effectiveness for recruitment is evident by exit surveys and freshman orientation interview answers where students informed us that this event had an impact on their decision to pursue technology degrees and/or apply to our technology degree program. This kind of high-visibility industry engagement has been a critical component of success in the RSC program. Others attempting to implement full pipelines are highly encouraged to find or create a similar experience for students throughout the technology and engineering career cycle to engage with and understand the needs and vision of industry leaders and professionals.

D. Women in Technology Panel

Another recruitment tool has been the annual Women in Technology Discussion Panel and Symposium. This year's program garnered over 125 female high school students, and approximately 50 female community college students. The discussion panel presenters are comprised of females, all of whom are CIOs, CEOs, entrepreneurs, and managers of large corporations such as Michelin and Sharon Graeber Architect LLC, and are employed in a STEM-related field. During the discussion, panel member share experiences about working in a STEM area, having male co-workers, the challenges faced, as well as, solutions used to overcome challenges faced while being a female in a male-dominated environment. The main objective for this event is to encourage females to pursue careers in STEM- related areas. Studies suggest that gender differences in terms of interest in science, technology, engineering, and math can begin at an early

age²². In many cases, females tend to feel they are neither competent enough nor have the ability to study disciplines that are traditionally male dominated. As a result, females end up having a negative attitude towards the STEM fields of study. This attitude towards the STEM study areas are further exaggerated when considering the fact that there are a limited number of female mentors, roll models, or peers to improve self-efficacy in this area.

The Women in Technology Discussion Panel and Symposium is instrumental in stimulating interest and conveying to females that they do not have to fit the traditional stereotype or perception that they cannot excel in STEM areas and should opt for a career in, perhaps, the humanities or social science disciplines. The symposium features female leaders who work in STEM-related environments. According to the America Association of University Women, this helps to reduce gender stereotyping as well as any negative connotations that females may have about pursuing a career in STEM¹⁷.

Our comment cards/exit surveys revealed that 57 percent of the female students were more likely to pursue technology field of study as a result of mentorship and the panel discussion. This demonstrates the value that young women gain from seeing successful females in STEM. Visibility of and interactions with women in STEM is an issue that needs more attention. Our experience hints at a greater need for role models who can address and demonstrate the place that women and minorities hold in building a strong STEM future.

E. Exploration of Science and Math in Technology (E.S.M.T) Summer Camp

Our E.S.M.T. Summer Camp was a one week hands-on technology, math, and science camp designed for rising 8th through 12th grade students. Participants engaged in math and science projects that drive technology. Students were immersed in technology laboratories with Math, Science, and Technology faculty, exploring the latest technological trends. Students explored:

- Math principals and applications needed for technology
- Science principles and applications needed for technology
- Robotics, Animation, Game Design, and other Technological areas
- Teamwork Abilities
- Presentation Practices
- Leadership Skills
- Problem-Solving Methods
- Creating and running a Content Management System (CMS) website (Wordpress & Joomla)
- Social Media Etiquette and Responsibilities
- Computer Troubleshooting and Network Security Techniques
- Digital Media (Audio & Video) Techniques

Phase Two: Support

Support is the second segment of the RSC pipeline to increase diversity in the technology profession. The second segment supports female students through the collegiate process with living-learning communities, workshops, community-building activities, and mentoring to support and retain them in technology programs.

A. Technology and Innovation Living and Learning Community

The university created the Technology and Innovation Living and Learning Community (LLC) to provide an opportunity for students to enhance their academic experience. The School of Technology promoted (and promotes) educational excellence in the LLC and supports students as they begin their college life. Through strong collaborations with Student Success, Academic Affairs and Student Affairs, the Living and Learning Community enabled students to experience a more educationally enriched community. These communities focused on a Residential Curriculum that guides the student toward competencies in global critical thinking and reasoning skills, social and civic responsibility, character, ethics, and communication. Data shows that structured activities, such as faculty interactions and LLC participation facilitate an easier academic transition for students^{20, 21}. The university created the Technology and Innovation Learning Community in 2012.

Students in the Technology and Innovation Living and Learning Community lived on the same floor of their dormitory, and benefited from the friendship and support of being in direct, daily contact with other students who share the same class block scheduling, academic interest, and course load. Supportive peer groups were formed by the freshman students, who developed a network of peers to help with the sometimes difficult transition to college level learning. As personal connections were developed in the community, students balanced their new lifestyle as they connected with students from various cultural backgrounds, shared life experiences, and expressed diverse viewpoints while challenging each other to evaluate and rethink their own perspectives. This LLC was an essential part of female student engagement through the Support phase of the program.

Students participating in the Technology and Innovation Learning Community also had specially designed programs and events to enhance student academic development and maintain life balance. By engaging these students throughout their experience, the connection to the School of Technology community became stronger and helped them to persist in their technology majors. Examples are as follows:

- Collaboration with faculty
- Study Groups
- Field Trips
- Academic Coaching and Workshops
- Contemporary Etiquette Dinner
- Honor Student Support
- Leadership Conferences
- Career Workshops

The Living and Learning Community students lived in a technology-themed residence hall and participated in academically and intellectually engaging learning activities designed for them exclusively. LLCs helped students create a strong link between their lives in the residence hall and the learning experience in the classroom. Studies show that Students in these communities were more involved in campus life, had more interactions with other students and faculty, and were more integrated into the learning environment²¹. The community provided a setting that was conducive to building a strong, cohesive peer network that served students throughout their academic and professional careers.

The Technology and Innovation LLC was first designed for the incoming first-year technology major freshmen in fall 2012. 39 percent of the students enrolled in this program are female. Academically, this 2012 LLC group outperformed students who lived on campus but did not reside in the community by a 21 percent higher GPA and 27 percent higher retention rates. The ongoing mission of the LLC continues to be supporting students in achieving success in their coursework and in exploring how technology impacts our global society. Students who reside in the LLC enjoy all the same amenities as other on-campus residents, while profiting from the unique technology-supporting living experience.

The program also supported and coordinated LLC student engagement with undergraduate research activities including attendance at local research conferences, participation in the annual Technology Week event (Extreme IT Day), campus laboratory tours, and career exploration activities. Students are encouraged to attend campus special lectures, academic enrichment workshops and seminars. Being in the LLC helped students' awareness of these events and provided a supportive peer group during attendance at events.

Students are accepted to the LLC on a first-come, first-served basis. The students also agreed to participate in the Innovation Living and Learning Community (LLC) by:

- Meeting all requirements needed to remain enrolled at the University
- Participating and contributing to events planned for the LLC
- Supporting the Living Learning Community meetings and programs
- Attending the LLC Orientation
- Respecting community members, resident assistants, peer mentors and others met while participating in this unique community
- Completing program assessments in the fall and spring

The Office of Student Success in the School of Technology has also worked with the Innovation LLC to support students in their quest to be successful in both academics and in career preparation. The Innovation LLC continues to have great success in helping promote and build partnerships between technology faculty, staff, and students. We also believe the LLC contributes to the intellectual climate of the university because the students outperform their peers on campus in terms of higher GPA's and retention rates.

B. Technology Week

Technology Week is an annual event, held during the third week of March, and is hosted by the University. The School of Technology is the lead of this event but the College of

Engineering and other campus units also get involved with Technology Week events. Various events are held throughout the week, aimed at keeping students engaged with the fast-changing world of technology. Technology and Innovation continue to evolve as they relate to graduates being ready for the 21st century workforce. President Obama has launched a campaign called “Educate to Innovate” in an effort to work with young people to improve their performance in STEM²⁴. Likewise, the School of Technology advocates preparing innovators for the future.

Technology Week sees over 1,000 students from middle schools, high schools, community colleges, and universities in the surrounding area who attend the event. Additionally, over 20 of our Corporate Sponsors participate in Technology Week by conducting presentations on leadership skills as well as offering guidance on interviewing skills and overall workplace culture.

The purpose of Technology Week is an opportunity to educate, inform, and display the field of technology and its place as a career choice. We bring together School of Technology students, faculty, and staff with high school students, community college students, and corporate partners to share the story of “Why Technology?” Not only is technology one of the fields that is in a job growth pattern, but it meets the strategic direction of the country in increasing jobs in STEM.

Many activities throughout the week are planned: typically Monday and Tuesday we showcase the seven undergraduate School of Technology programs, and on Thursday we present a historical view of Technology, as well as the history and culture of the School of Technology.

Phase Three: Connect

The final segment of the RSC pipeline is connection/networking. Aside from the technical or academic component, another vital aspect of student success is centered on the student’s professional and community life skills, which are essential for success in academia and other professional environments. Mentorship and pre-workforce experiences such as internships are paramount for a successful transition into the workplace.

A. Employability Skills

In the past, there were concerns regarding students not being more marketable and not meeting industry demands. Therefore, representatives from industry, our advisory board committees, and former graduates addressed the need to better prepare students for successful careers. The program was developed around a series of workshops to improve the employability skills required for graduates entering the workplace. This workshop program was (and still is) an alliance between industry, academic leaders, and career service programs. The objectives were to provide students with precise data from various resources that will be crucial for their successful career. The workshop activities included: good planning and organizing skills, problem-solving, reasoning, and creative thinking skills. Also, teamwork exercises have been built in throughout,

reflecting the modern workforce where many tasks involve work groups.

The workshops were designed to focus on teaching and training the students. The design used several activities from professionals in the field, the advisory board, and faculty members within their program of study. What made this workshop design different is the participation from each entity in the alliance and their knowledge about technology programs. The objectives for the workshops are accomplished by the following activities:

1. The students joined American Toastmasters or similar organizations which assists them with soft skills and helps them with their writing skills and public speaking.
2. Students received job training through practical lab assignments and real life applications. The students then present discoveries and are evaluated by their peers, industry, faculty, and advisory board.
3. Increase students' technical, writing and verbal communication skills by giving mock interviews and receiving feedback. Additionally, students received assignments where they must research and write reports about perspective companies which include the company's mission statement and recent accomplishments. All of these must be completed before interviewing with prospective company.

B. Job Training Through Partnership

The primary goal of the Connect phase of the program was to prepare students for the workplace. The job training through partnerships program shares this focus. It is essential that academic program partners with industry so that students can gain the necessary skills that are employed in the workplace. The objective of this program is to network with companies that are interested in hiring students from North Carolina A&T State University. The overall goal was to learn and implement best practices through on-the-job training through internships and/or shadowing a company manager. Also, students were trained through workshops on how to build effective relationships with the employer and employees in the working environment. The students' objectives were to find an internship or shadowing opportunity on a job that relates primarily to their program of study or area of interest. The students' utilized knowledge gained from the course of study and applied it to an actual real world job.

During the beginning of the academic year, students submitted a plan of action to the project coordinator and academic advisors detailing their activities and learning outcomes with their selected employer/mentor. One key feature of this training and internship program is that the employer provides students with information that is instrumental for job placement. The student is partnered with a manager/mentor who will be responsible for training them on the daily activities that are implemented on the job. Studies have shown the effectiveness of mentorship and role models²². Students train with a manager who observes and evaluates their performance for 10-12 weeks meeting at least one day per week. The on-the-job activities consisted of the following being provided by the Intern's employer:

- providing an orientation to introduce the student to the employees and familiarize them with corporate policies
- providing relevant field experience in managing projects
- involving students into various tasks which will provide them meaningful work experiences in office operations and field operations
- engaging students in state of the art technology used for current projects
- providing meetings for the students to attend with the manager
- teaching students how to write technical reports and communicate effectively
- reinforcing time-management strategies and ethics in the internship workplace

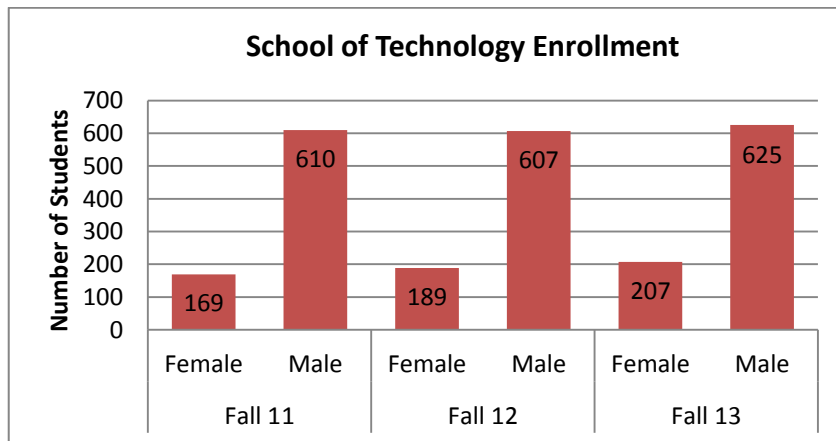
At the end of each academic year the project coordinator, advisor, and manager evaluate the student’s performance and knowledge gained. The student then gives a final presentation on their achievements during the semester such as internship experiences, employability skills acquired, mentoring relationships, and placement opportunities.

Since 2011, we have seen a considerable increase in student job placement. Our assessments for the effectiveness in the past for the employment connection stage of the pipeline had been less than desirable. Before 2011, there were no mechanisms in place to track job placements and post-college activities for the students in the SoT. A senior survey and alumni survey was created to examine life trajectory in terms of career choices, salary, job satisfaction, attitudes about career preparedness and overall satisfaction. The response rate for the alumni surveys were relatively low, only 22 percent. However, the overall satisfaction and career preparedness for responding graduates showed that over 50 percent of those alumni responded positively. In 2016, we can use a comparative analysis for our first full RSC cohort and a comparison group of non RSC participants.

Conclusions

The RSC pipeline utilizes the learning community of students with a common interest in technology. The program is modeled on a strengths-based approach, in order to aim to reach best practices from such programs such as the Meyerhof Scholars Program.

Figure 3: SoT Student Enrollment by Gender



After closely examining the numbers since the inception of the RSC program, we noticed each year our student enrollment increased, but with different distributions (see figure 3). From 2011 to 2013 we have seen a 22 percent increase in female enrollment as opposed to 2 percent increase for males. In 2011, the female enrollment was 22 percent and male enrollment was 78 percent. In 2012, the female enrollment was 24 percent and male enrollment was 76 percent. In 2013, the female enrollment was 25 percent and male enrollment was 75 percent. However, the numbers for female enrollment are still disproportionally low at only 25 percent. The RSC program will be continuing into the future with an eventual goal of achieving gender parity in the School of Technology.

Future studies for assessment will be triangulated through multiple data sources for comparative analysis. A complete study of the effectiveness of this program cannot be finished until 2020, but preliminary data looks promising and show the strengths of certain components. Beginning in fall 2015, we will have 3 six-year cohorts tracking students through each stage of the pipeline. We will examine and report program impact in terms of broad outcomes such as retention, persistence, time-to-completion, grades, and ongoing interest. Pre and post surveys for each component will collect participant reactions, development, and insights. We will also have a comparison group composed of non-participants. All students are being followed; those that do not participate will be tracked as a comparison group. Semi-annual surveys will be sent to ask those non-participants for their experiences as well. The four groups – three cohorts and the nonparticipant comparison group – will provide a wide range of insights for assessment and outcomes. The analysis will provide rich insights for future diversity support. The next steps for the RSC program will be to be awarded funding to provide merit-based scholarships for participants; studies suggest that the growing cost of post-secondary education is also a factor causing low numbers in college enrollment.

The School of Technology has broadened participation for females in the technology field by creating a program that is specifically designed to offset inherent disparities in technical career preparedness between genders. This has been accomplished through enhancing discovery and understanding for the technology field at large and bolstering an environment in which all parties gain community life experience through a portal that utilizes mentorship and collective effort to pool scientific expertise which is paramount for continued growth in any discipline. The modular nature of the Recruit, Support, and Connect program fosters a model that can be easily replicated for any program with similar objectives. By scaffolding existing programs together with targeted support and mentoring, this approach could be adapted to a wide variety of university environments.

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