ENGAGE 2Be Engineers Mentoring Program for Minority Students

Dr. Matthew B. A. McCullough, North Carolina A&T State University

NC A&T Alumnus graduated from A&T in 2001 with a B.S. degree in Industrial Engineering. Dr. McCullough obtained his Ph.D. in Biomedical Engineering from the University of Iowa in 2006, under the advisorship of Dr. Nicole Grosland. His research focused on hand and wrist musculoskeletal biomechanics, and in particular total wrist arthroplasty and upper extremity kinematics. This experience was especially rewarding as Dr. McCullough was afforded the opportunity to work with Dr. Brian Adams, a well-known hand surgeon. In the summer of 2006, he began a post-doctoral fellowship at Mayo Clinic, working on orthopaedic biomechanics and physiology cellular imaging laboratories. This provided the opportunity to work with outstanding clinical and research mentors like Drs. Kai-Nan An, Kenton Kaufman, Gary Sieck, Ann Reed, Harold Kitaoka, as well as others. His research at that time focused on non-invasive imaging of muscle tissue as well as cadaveric studies of the foot and ankle. Dr. McCullough is a faculty member of the first bioengineering program independently housed at a Historically Black College or University and is a part of the NSF ERC-RMB which includes research on the biomechanics of degradable medical devices. He is passionate about educating undergraduate, and graduate students, as well as the general community in biomechanics, biomedical engineering and the S.T.E.M. fields.

Dr. Stephanie Luster-Teasley, North Carolina A&T State University

Dr. Stephanie Luster-Teasley is an associate professor with a joint appointment in Civil Engineering and Chemical Engineering at North Carolina A&T State University. She specializes in Environmental Engineering and her research interests include water and wastewater treatment, water reuse, sustainability, and engineering education.

Dr. Clay Gloster Jr, North Carolina A&T University (Tech)

Clay Gloster, Jr. is currently serving as the chairperson in the Department of Computer Systems Technology at North Carolina A&T State University. He received the B.S. and M.S. degrees in Electrical Engineering from North Carolina A&T State University (Greensboro, NC) and the Ph.D. degree in Computer Engineering from North Carolina State University (Raleigh NC). He also has been employed with IBM, the Department of Defense, the Microelectronics Center of North Carolina, North Carolina State University, and Howard University.

His research interests are in the general area of reconfigurable computing. Current research focuses on the development of a suite of software tools that allow scientists to benefit from the potential order of magnitude speedup in execution time offered by reconfigurable computers over typical desktop computers. Dr. Gloster has also conducted research in the area of technology-based curriculum development, distance education, and VLSI design for testability.

Dr. Gloster has taught courses on digital system design, ASIC design, microprocessor system applications, FPGA-based system design, and VLSI design for testability (using VHDL/Verilog). He has served on the program committee and as session chair for several international conferences. He received best paper and presentation awards for a paper presented at the International Conference on Computer Design and has received numerous fellowships and distinguished awards. Dr. Gloster holds one US patent and led the effort to establish a new BS degree program in Computer Engineering at Howard University.

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Marcia Williams is the Director of STEM/Sponsored Programs in the College of Engineering at North Carolina A&T State University, and has more than 20 years of experience in organizational development, strategic planning, proposal development, and grants implementation and administration. Marcia earned a B.S. in Industrial Technology from North Carolina A&T State University, an MBA in Management from Wake Forest University, and a Ph.D. in Leadership Studies from North Carolina A&T State University.

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As Co-Principal Investigator and Statewide Project Director for the North Carolina Louis Stokes Alliance for Minority Participation program (NC-LSAMP), and Co-Principal Investigator and administrative manager for the NSF Innovation through Institutional Integration (I-3) project, she is a strong advocate for broadening the participation of underrepresented populations who major in, and complete STEM undergraduate and graduate degrees. Dr. Williams has been instrumental in garnering over $8 million in grants to support undergraduate research and interdisciplinary outreach programs, and has facilitated faculty-led research experiences on campus and at Argonne, Brookhaven, and Lawrence L. Livermore national laboratories.She is a Councilor in the Undergraduate Research Program Directors Division of the Council on Undergraduate Research,and member of the CUR Broadening Participation Task Force. She also serves on advisory boards for the NSF Historically Black Colleges and Universities Undergraduate Program (HBCU-UP), the NIH Minority Access to Research Careers (MARC) program, the NSF Research Internships in Science and Engineering (RISE) program, and the Institute for Broadening Participation (IBP). She is also a member of ASEE.

Prof. Ronnie S. Bailey, North Carolina A&T State University

Ronnie Bailey is an Associate Professor in the Civil, Architectural, and Environmental Engineering program at North Carolina A&T State University. He has both professional and teaching experience in architectural engineering and urban planning; furthermore, he has worked as a design consultant and planner for both private and public projects. Due to Professor Bailey's pedagogy of teaching, he has been honored with receiving the Teacher of the Year award from his department on six occasions and the Teaching of the Year award for outstanding teaching from the College of Engineering, twice. For the College of Engineering, he has done a superior job in developing and coordinating the Introduction to Engineering Design; evaluations from students and alumni suggest that the course has not only helped increase retention among freshman students, but also provides a more realistic view of how the engineering design process works in industry. Professor Bailey's courses also provide the student with knowledge of the work environment and team spirit expected of engineers in the workplace. At NC A&T he has helped initiate programs to address the critical issues of increasing the diversity initiative of professional development and preparation of working in a global society. He has provided opportunities for students to have international experience by coordinating different types of study aboard experiences that appeal to a broad range of students; number of sites include Oxford University, London, England, Paris, France, Rome, Italy, Greece, Germany, and Switzerland. In the Oxford England Program at Oxford Brookes University he served as a consultant for a summer program. At the present time Professor Bailey is helping coordinate a program with Virginia Tech's College of Engineering and North Carolina A&T State University; "Rising Sophomore Abroad" program. This program will expose students to not only the culture of the country, but also engineering industries and universities abroad.

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ENGAGE 2BE Engineers Mentoring Program for Minority Students

Abstract

Engaging the Next Generation of African-American Graduates Entering Biomedical, Biological, and Environmental Engineering Careers (ENGAGE 2BE) aims to address the current worker shortage and lack of diversity in various fields of engineering. Improving the diversity of viewpoints and experiences within the engineering field will fuel innovation and draw on a talent pool that will fill the current workforce needs. In order to increase underrepresented minority (URM) participation in engineering multiple strategies must be employed, two of which are increasing the retention and completion rates of URMs and women in engineering B.S. programs; as well as increasing the number of URMs and women that attend and complete graduate school in a science, technology, engineering, or math (STEM) field.

An impactful mentoring program has been designed and implemented that leverages student strengths through social media to support students as they matriculate towards their B.S. degrees. Now entering its second academic year the ENGAGE 2BE program targets students who are URM, low income, first-generation, from immigrant or migrant worker families, have disabilities, or have children. The program provides mentoring academic support, and professional development through impactful workshops on understanding your strengths, being successful as a woman in a field highly populated by men, and preparing for graduate school. In addition, support is provided for student travel, to increase professional development and preparation to work in a global society. This paper reports on the ENGAGE 2BE program including program motivation, operations and management plans, as well as current assessment data and lessons learned. The information provided will aid others who are interested in strengthening support networks for undergraduate students in engineering.

I. Introduction

The American Society of Engineering Education (ASEE) Survey of Engineering and Engineering Technology Programs has identified North Carolina A&T State University (NCA&T) as one the leading producers of African American B.S. level engineers and among the top three leaders for producing BS level African-American female engineers[1]. This designation is often pursued by many prominent universities, such as Georgia Institute of Technology, Prairie View A&M and Florida State/Florida A&M, resulting in these universities alternating between the top for rankings for the last five years[1, 2]. The numbers of Under-Represented Minority (URM) engineering students continue to remain low in comparison to the representation in the general population[2].
Despite efforts to increase the diversity of the engineering profession, nationally African Americans, Native Americans and Hispanics collectively represent only 11% of students completing BS level engineering degrees[3, 4].

The goal of the ENGAGE 2BE Engineers Program is to focus mentoring, academic support, stipends and professional development opportunities for students at North Carolina A&T State University interested in pursuing graduate study and careers in Biomedical, Biological and Environmental Engineering. This program focuses on four key objectives:

1) Increase the number of minority students who obtain a Bachelor's degree and are academically prepared to pursue graduate degrees in biomedical, biological and environmental engineering.

2) Provide support, mentoring and on-campus resources to increase retention of non-traditional and high-needs students (e.g. students with disabilities, students from low-income families, students from immigrant and migrant worker families, and students with children) enrolled in the departments of Chemical, Biological, and Bioengineering (CBEN) and Civil, Architectural, Agricultural and Environmental Engineering (CAAE).

3) Implement high throughput data management methods to increase real-time advising and mentoring, and

4) Establish a sustainable mentoring program which will continue to serve students in CBEN and CAAE long-term.

Historically, 84% of the students in NCA&T's College of Engineering (COE) have been African-American. Table 3 demonstrates the number of students enrolled in NCA&T's engineering programs from 2006 – 2010 [5]. Table 4 provides the ethnic representation in civil engineering, chemical engineering, bioengineering and the College of Engineering as a whole[6]. Statics and tracking of students with children and students with disabilities however is not part of the overall demographics collected about engineering students. Even though we know there are a significant number of single parents and students with children represented on campus they are often an ignored, underserved population[7, 8]. Additionally, there are a number of students with disabilities, both physical and learning disabilities, where because of legal and privacy issues are not identified, mentored, and supported at a level that could help increase their retention and success.

Table 3. Student Enrollment in NCA&T's College of Engineering (Source: NCA&T Factbook Data Management[6])

	Fall 2006	**Fall 2007**	**Fall 2008**	**Fall 2009**	**Fall 2010**	**Fall 2011**	**Fall 2012**
Program Title	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**	**Total**
Architectural Engineering	232	185	179	159	139	131	119
Civil Engineering	116	95	97	98	97	106	128
Computer	228	195	195	205	193	192	183

Science							
Electrical Engineering	284	224	221	214	198	180	153
Computer Engineering	134	131	124	129	126	129	130
Industrial Engineering	190	154	122	123	103	106	125
Mechanical Engineering	256	233	220	228	214	208	224
Chemical Engineering	100	85	82	90	81	67	72
Bioengineering	n/a	n/a	n/a	n/a	4	17	41
College of Engineering Total	**1540**	**1302**	**1240**	**1041**	**1155**	**1136**	**1175**

Table 4. Ethnic Make-up of Students in Civil, Chemical and Bioengineering (Source: NCA&T Factbook Data Management[9])

			% of Population					
Department	**Ethnicity**	**N**	WHT	AA (Blk)	IND	AS	HIS	OTH
Civil Engineering	Fall 2009	98	19.4	68.4	0.0	0.0	6.1	6.1
	Fall 2010	98	18.4	70.4	0.0	1.0	5.1	5.1
	Fall 2011	106	17.9	68.9	0.9	0.9	3.8	6.6
	Fall 2012	128	14.8	75	-	1.6	2.3	6.3
Chemical Engineering	Fall 2009	90	3.3	87.8	1.1	2.2	2.2	3.3
	Fall 2010	81	6.2	79.0	0.0	4.9	1.2	8.6
	Fall 2011	67	4.5	83.6	-	3.0	1.5	7.5
	Fall 2012	72	4.2	73.6	-	8.3	2.8	11.1
Bioengineering	Fall 2010	4	25	75	-	-	-	-
	Fall 2011	17	-	82.4	-	-	-	17.6
	Fall 2012	41	12.2	80.5	-	-	2.4	4.9
NCA&T Engineering Total*	Fall 2009	1257	7.4	83.6	0.4	2.1	2.2	4.2
	Fall 2010	1158	7.3	82.0	0.4	2.8	2.7	4.7
	Fall 2011	1317	7.0	83.0	0.5	2.4	2.4	4.2
	Fall 2012	1256	8.1	81.3	0.2	2.3	1.9	5.9

Goals for E2BE Mentoring Program

The ENGAGE 2BE program is interested in increasing retention rate of students, freshman through senior year and increasing the percentage of students who graduate in 4 years and pursue graduate school. The CAAE and CBEN programs tend to have a higher percentage of female

students within their programs compared to the fields of Mechanical, Electrical, and Computer Science. The ENGAGE 2BE program is based on a ***strengths-based model*** approach. Strength-based models are educational intervention methods which focus on enhancing the existing strengths of a student and building upon these strengths as opposed to focusing on remediating deficiencies [10, 11]. The four factors embodied by a strengths-based approach are: (1) Academic and Social Integration, (2) Knowledge and Skill Development, (3) Support and Motivation, and (4) Monitoring and Advising. This model has been proven to effectively enhance minority students' success in the sciences, math and medical careers in programs such as the Meyerhoff Scholars Program at the University of Maryland Baltimore County (UMBC) which was initially designed to increase the number of minorities pursuing PhDs in medicine and the sciences [10, 11].

What makes ENGAGE 2BE different from other educational programs is the focus on developing undergraduates' self-confidence in their abilities to succeed in undergraduate studies, pursuing graduate school, and extended mentoring for our high-needs target population of low-income, first generation, students of immigrants and migrant worker families. Development of this self-confidence is especially important as student performance is impacted by self-confidence and self-identity as it relates to engineering[12]. The program would be the first of its kind in the College of Engineering where students who have children can receive specialized mentoring to ensure their academic progression towards earning their BS degrees. We will use the strength-based model to help our under-represented minority groups excel in their undergraduate studies and prepare them for success in graduate school. Additionally, we seek to develop a program that can be sustainable at NCA&T by establishing a mentoring and supporting culture for students in bioengineering and environmental engineering. We have received considerable support from the Dean of the College of Engineering, our University's Division of Research, and Director of the North Carolina Louis Stokes Alliance for Minority Participation (NC-LSAMP) program. Our goal is to form the basis for a pipeline to produce students who will become leaders in bioengineering and environmental engineering fields for years to come.

II. Implementation

The Departments of Chemical and Bioengineering (CBEN) and Civil, Agricultural, Architectural and Environmental Engineering (CAAE) are the target groups for Engage2BE because these departments offer majors which lead to careers in bioengineering (i.e., biomedical, chemical and biological) or environmental engineering and tend to have a higher percentage of female students within their programs compared to the fields of Mechanical, Electrical, and Computer Science (Table 5). The CBEN Department offers undergraduate degrees which include specializations in biological and bioengineering. The CAAE Department offers an undergraduate degree in agricultural (i.e., bioenvironmental/ biological) engineering and specialization within civil engineering for students interested in environmental engineering, two of the fastest growing industries in the world. Hence forth, the majors and specializations in CAAE for bioenvironmental and environmental engineering will be referred to as environmental engineering.

Table 5. Gender make up of Students in CAAE and CBEN
(Source: NCA&T Factbook Data Management[5])

			Fall 2008		Fall 2007		Fall 2008		Fall 2009		Fall 2010	
Dept	**Program**	**Ethnicity**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
Civil, Architectural, Agricultural, And Environmental Engineering	Architectural Eng	WHT	2	11	-	9	1	7	1	8	2	6
		BLK	54	101	41	100	37	83	37	73	39	61
		IND	-	-	1	-	-	-	1	-	1	-
		AS	1	4	-	3	-	3	-	3	-	2
		HIS	-	4	-	3	-	5	-	5	-	3
		OTH	-	2	-	3	1	3	1	2	2	3
	Civil Eng	WHT	1	19	-	19	1	17	3	16	5	14
		BLK	22	49	24	43	25	44	21	52	29	67
		IND	-	-	-	-	-	-	1	-	-	-
		AS	-	2	-	-	-	1	-	2	-	2
		HIS	3	1	2	4	-	5	2	2	1	2
		OTH	-	-	2	4	-	5	2	5	1	7
	Total		83	193	70	188	65	173	69	168	80	167
			Fall 2008		**Fall 2009**		**Fall 2010**		**Fall 2011**		**Fall 2012**	
Chemical, Biological & Bio Engineering	**Program**	Ethnicity	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**	**F**	**M**
	Chemical Eng	WHT	1	2	1	2	1	4	-	3	-	3
		BLK	43	33	49	30	38	26	37	19	32	21
		IND	-	-	-	1	-	-	-	-	-	-
		AS	-	1	1	1	1	3	2	-	3	3
		HIS	-	1	1	1	1	-	-	1	1	1
		OTH	-	1	1	2	4	3	2	3	3	5
		WHT	NA	NA	NA	NA	-	-	-	-	2	3
	Bioengineering	BLK	NA	NA	NA	NA	-	4	11	3	25	8
		HIS	NA	NA	NA	NA	-	-	-	-	1	-
		OTH	NA	NA	NA	NA	-	-	-	3	1	1
	Total		43	38	53	37	45	40	52	32	68	45

Student Selection Criteria

Our initial goal was to maintain an average of 20 – 25 participants each year. In August 2012, applications to enroll in the program were announced in the College of Engineering. Students completed applications that included an essay portion to help reviewers identify students with a genuine interest in biomedical engineering, biological engineering, bioengineering, and environmental engineering. The essays were also reviewed for students' interest in pursuing

graduate study. The criteria for was based on a GPA of 3.0 of higher to emphasize the GPA needed for successful admission into most graduate programs. Our high-needs target populations of low-income, first generation, students of immigrants and migrant worker families were identified based on self-identification and recommendation by faculty/staff who have knowledge of a student meeting the criteria. Students were expected to maintain a GPA of 3.0 or higher and participate in E2BE sessions and workshops.

Forming a Mentoring Community

ENGAGE 2BE formed a living and e-learning communities of students with common interests in bioengineering and environmental engineering. One additional community formed by the program provides support for students with children, low-income, first generation, students of immigrants and migrant worker families to provide mentoring and support to help them complete their undergraduate degrees, help them secure on-campus undergraduate research experiences and consider graduate study. Female students with children and our older returning students also formed a peer-to-peer mentoring community where they readily help each other with support and mentoring for navigating family responsibilities and academics. Therefore, our program has become very diverse in representation for all minority groups including Hispanic, Caucasian and Native American students. ENGAGE 2BE will use social media and cloud computing to increase student interest in biomedical, biological, and environmental engineering and form both a "Living" and an e-Community that reaches beyond North Carolina A&T State University.

Seminars

The E2BE program hosted a total of seven professional development workshops and sessions. These included: 1) Strengths-Quest: Learn your Personal Strengths, 2) An Assessment to find Engineering Strengths (Senior Session), 3) Cultural Competencies, 4) Improving time management, 5) Applying to graduate school, 6) Developing Successful resumes for careers in engineering, 7) E-week banquet, and 8) Students additionally met with the advisors for mentoring sessions. An Example of the schedule is provided in Table 6.

Table 6. Examples of topics for mentor advising and workshop themes

Month	Mentoring Theme
August	Introductions
September	StrengthsQuest and Engineering Strengths
October	Graduate school advice
November	Time Management; Applying for REUS
December	Surveys and assessment
January	On-line Rubric mentoring sessions
February	E-week Celebration
March	Grades and rubrics Applications for summer research submitted College of Engineering ELITE Center

April	The Ladies' Survival Guide in Academia and Career: What to do in a Male Dominated Field
May	Wrap-up

Graduate student, undergraduate student, and summer support for students and faculty
We provided stipends and financial support for four graduate students and three undergraduate students in the program to assist with development and management of the program activities. Funding was also provided for academic year research for undergraduate students.

E-mentoring, Surveys, and Assessment Tools
An on-line format for the e-mentoring rubric was developed using the software Qualtrics. This portal provided a secure method for students to provide information about their performance during the Fall and Spring semester. The mentors could review this information prior to mentoring sessions to improve real-time mentoring. Students could also meet face to face with mentors for academic and career advice. Assistance such as proofreading personal statements for graduate school and undergraduate research applications were also provided.

Freshmen through juniors participated in a workshop called StrengthsQuest sponsored by Northrup Grumman for the College of Engineering at NCA&T. A two –day seminar was hosted to teach students about 34 strength areas identified within the program and how to maximize their skills by playing into their strengths http://www.strengthsquest.com/home.aspx. This tool is a professional development survey designed to help companies aid their employees in identifying their key strength areas. Due to the cost of the program, 21 of the E2BE students participated in the StrengthsQuest program.

The twelve E2BE seniors participated in a 120 Engineering Strengths Assessment tool developed by the E2BE faculty using Qualtrics Software. This tool was IRB approved and the E2BE seniors completed the on-line survey. From their responses, a total of five strength areas were identified and used during a one-on-one mentoring session. This is an especially important process as students self-assess efficacy as they prepare to work in their field[13].

III. Results

Participants
For year 1, a total of 32 students were part of the E2BE program. The demographics consisted of nine freshmen, four sophomores, seven juniors, and twelve seniors applied and were accepted into the program. Of the students accepted into the program, 27 are African American, 3 Hispanic, 1 Native American, and 1 non-traditional Caucasian student. 91% of the participants currently receive financial aid support, two female students have children, and nine participants are first generation college students. Between Fall 2012 to Fall 2013 semester, ten of the twelve seniors graduated and continued into jobs or graduate school.

For year 2, nineteen of the students returned to the program from the inaugural group, two students left the university due to personal or severe financial reasons, one student was released

from the program due to lack of participation, and ten of the twelve seniors graduated and continued into jobs or graduate school. Applications for E2BE for year two were opened in September. A total of 24 new applications were received and the students were accepted into the program. Our current roster includes 43 students consisting of three freshmen, four sophomores, twelve juniors, and eleven seniors. Figure 1 is a photo of the 2013- 2014 student participants in E2BE.

Figure 1. Students in the E2BE program

E2BE Assessment real-time Mentoring

An on-line assessment tool was developed to help faculty mentors provide substantive mentoring during sessions. A rubric to help gage student performance during the fall semester was completed by the students prior to their Spring mentoring sessions (Figure 2).

Figure 2. Example of Student Mentoring Rubric (Copyright © Luster-Teasley 2011)
low success = 1 and high success = 5

	5	4	3	2	1
GPA	3.5 - 4.0	3.0 - 3.49	2.5 - 2.9	2.0 - 2.49	less than 2.0
Time Studying	15 hrs or more per week	11 - 14 hrs per week	1 - 5 hrs per week	less than 1 hour	I do not study for classes
Academic Advising	I see my advisor regularly for class scheduling, to discuss challenges, and to get advice.	I know my advisor and visit him/her for class scheduling. I occasionally visit my advisor	I know my advisor but only visit him/her for class scheduling	I know who my advisor is but I don't see him/her for advisement or class scheduling	I do not see my advisor and/or I do not know who my advisor is for my academic program
Social Time	I have balance between my social time and study time and my grades are between 3.5 - 4.0. The socialization rarely interferes with class performance	I have balance between my social time and study time but my grades are between 3.0 - 3.5. I could devote more time to increase my grade performance	I socialize but my grades could significantly improve if I increase my study time	I socialize and at times the socialization interferes with grades but not to the point where my overall grades in a class suffer	I socialize to the point where my grades are suffering and I do not have or devote time to study
Interactions with my Professors, Teaching Assistants and study groups	I see my Professor(s) and/or Teaching Assistant(s) regularly, I have a study group that is working well, and I am performing well in class	I occasionally see my Professor(s) and regularly visit my Teaching Assistant(s) to have questions answered; My study group works well and I am understanding course material	I interact occasionally with the Teaching Assistant(s) but have a study group that helps me understand course material or homework and we are completing assignments correctly	I rarely visit my Teaching Assistants and if I do it is just before a homework assignment is due or exam; I work with a study group but the group does not help me understand course material or homework	I do not see my Professor or Teaching Assistant(s) for assistance of any kind; I do not work in a study group

Using Qualtrics software, the rubric was converted to an on-line and mobile application survey. The student responses were downloaded by the faculty mentors and could be used to help with the mentoring discussion. Students indicated they felt the Strengths-based mentoring using the assessment tool and the use of the on-line survey before the mentoring session helped make their in-person sessions more meaningful and informative.

Use of Social Media and Blackboard

A Facebook page was established to distribute information about jobs, graduate school, professional development opportunities, summer research programs, and announcements for successes of students in our program. Interestingly, the 32 E2BE student participants also told other students about the E2BE Facebook page resulting in 75 Facebook followers who LIKED our page as of December 2013. By LIKING a page, students are able to receive posts from our E2BE site without sharing any personal information. Since inception in June 2012 after we received notice of the grant award, a total of 281 posts have been uploaded to Facebook. We linked the FB page to a Twitter account however found that more students utilized Facebook to receive notifications.

An internal on-line Blackboard group for the students in the program was created as a central location or "clearinghouse" where students could download application forms and find out information about Facebook posts. Between September 2012 and May 2013, information for 29 internships, undergraduate research and summer research opportunities and scholarships were posted for the students.

As part of the program, we will develop a website called the Undergraduate Research Clearinghouse that will list undergraduate summer research opportunities and graduate programs seeking students, especially minority students. This website will be open, freely accessible for undergraduates, and be a location where we will offer any college, university or research lab the opportunity to provide information about their summer research programs and scholarships.

Student Success Stories

As a result, of the year one E2BE activities and in particular the information from the FB page, five students are currently enrolled at research 1 institutions, five students continued onto graduate study at NCA&T. These schools include the University of California Berkley, University of Michigan, University of Arkansas, Penn State, Wake Forest, and North Carolina A&T. Compared to previous years, we saw an increase in the number of students applying for internships and REU experiences with over 70% of the students applying to graduate school, summer research, and for internships. Seven students participated in research conferences by presenting posters or oral presentation. Notably, students who were accepted into REU programs participated in internships at schools traditionally that have not hosted NCA&T students these included REUs and internships at Massachusetts Institute for Technology, the University of Arkansas, US Army Corp of Engineers, and University of Florida. Eight students participated in global experiences including one student working with an NGO for the installation of water treatment systems in Tanzania. Two students entered directly in the PhD programs.

(a)

(b)

(c)

Figure 3a - c. Student participating in conferences during the 2012 – 2013 fund year

Students who participated in the academic year program were eligible for summer stipends and scholarships during the Fall 2013 academic year. A total of twenty-five stipends and additional scholarships were awarded between Spring 2013 – Fall 2013 to students who maintained 3.0 GPAs and participated in summer activities such as internships, co-ops, undergraduate researcher or international experiences. Six students decided to use their stipends toward international professional development experiences. The students decided to participate in two different programs offered by NCA&T. One was a ten day educational tour in Barcelona and Madrid Spain. The other program was a partnership program with Virginia Polytechnic University (Virginia Tech) called the Global Engineering Practice, which was a three week program that students traveled to Italy, Switzerland and Germany. The Barcelona and Madrid Spain program was open to all students at NCA&T. The Virginia Tech Partnership program was for rising sophomores only. Engage2BE offered a seminar on cultural competencies and understanding global experiences, led by Prof. Ron Bailey. During the session, the goal was to provide students with an understanding of the value in an international educational experience, to help them grasp the importance of being prepared to work nationally and internationally. The programs provided an international experience which engaged students in the culture, customs, political and social environment of the countries visited.

IV. Conclusion

Overall, both the students and faculty have seen the benefits in the E2BE mentoring activities. Using the student strengths and building on their strengths has provided the opportunity for students to increase in their self-efficacy. We are currently in Year 2 of funding and plan to work with other STEM programs at NCA&T to host the monthly sessions. Facebook coupled with Blackboard continues to be the best form of communication with the students for sharing information. The success of our Facebook page has resulted in the College of Engineering increasing its use of social media. Students who used their stipends for international experiences expressed an interest in traveling abroad again, which reinforces the need for minority students to become acclimated with international knowledge, cross- cultural communication skills, and intercultural competence because of interconnectedness and global economic interdependence of todays' world.

By year 3, we will have statistics for all of the students who have matriculated through the program since 2012 and will compare these results to previous senior exit surveys completed by the College of Engineering. For the 2013-2014 application period, we admitted three freshmen who will be the last set of freshmen admitted and mentored through their senior year. We anticipate being able to share our data and methods with our college to integrate the program into the student services offered within the College of Engineering at NCA&T. We will also work with the collaborative STEM group that has now formed on our campus to link all of the STEM funded programs to leverage resources and efforts to strengthen the impact our programs have in increasing the number of minorities and women entering STEM careers.

V. Acknowledgements

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