Using Technology Summer Camp to Stimulate the Interest of Female High School Students in Technology Careers

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Abstract--**Increasing the pool of qualified workers 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. The 2015 Females in Technology (FiT) Summer Boot Camp project was a summer residential technology boot camp for low income rising high school junior and senior girls. The objective of the 2015 Summer FiT boot camp was to increase the number of low income female students who pursue degrees in technology disciplines at the collegiate level and who are prepared for a technologically rich workforce. As a recruitment tool, we anticipate increasing the enrollment of female students in the School of Technology. The methodology for the FiT Boot Camp was a short-term intensive hands-on experience which was the first of its kind at NCA&T. The preliminary results have been more than promising. The pre and post-test surveys indicate a positive trend in terms of knowledge gained, interest, and attitude towards technology. Not only did this program stimulate interest in the technology profession, it also introduced female students to new and innovative technology concepts while reinforcing and improving technology and leadership skills.**

I. INTRODUCTION

During the last several decades, there has been a growing public consensus that it is vital to prepare a qualified Science, Technology, Engineering and Mathematics (STEM) workforce that will generate a profound impact on the nation's economy, prosperity, and competiveness. The Executive Summary for "Rising Above the Gathering Storm: Energizing and Employing America for A Brighter Economic Future," reported that "scientific and technological building blocks critical to our economic leadership are eroding at a time when many other nations are gathering strength" [1]. This report is one of many that record the nation's decline in educational foundations for technology-based innovation. According to US Bureau of Labor Statistics, the STEM workforce is under-filled: only 6% of U.S. workers are employed in the STEM fields, but they are responsible for more than half of our sustained economic expansion [2]. In the last decade, STEM jobs grew three times faster than non-STEM positions [3]. The demand for STEM professions is projected to continue climbing in the next 10 years; however, recruiting skilled employees poses a challenge for many companies, with an even greater one for underrepresented minority candidates [4].

The diversity shortage is also a challenge to be overcome; diverse teams bring proven competitive advantages [5]. 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 2010 [6], even though women make up 51 percent of the population. This discrepancy is quietly undermining one of our nation's key assets, diversity. The U.S. cannot maintain its global competitiveness without an influx of more STEM workforce members and members who have diverse perspectives. Therefore, the U.S. must rethink our strategy to meet these priorities.

The 2010 report of the President's Council of Advisors on Science and Technology highlights the achievement gap among some groups in STEM and the underrepresented African Americans, Hispanics, Native Americans and women are seriously underrepresented in many STEM fields [7]. Furthermore, many underperforming K-12 school systems are contributing to the achievement gap by employing teachers who in many cases lack the knowledge to effectively teach science and math that would advise and inspire a new generation of students to consider STEM fields. Many see this as a contributing factor for American students' lack of interest in science, in comparison with other countries, particularly China and India.

Further complicating the issue are also concerns about the rising cost of post-secondary education. For example, private universities at the high end can cost upwards of $60,000 per year (or more) while public universities cost on average $19,000 [8]. College affordability is a challenge for most working-class and low-income families. According to *Current Population Survey, Annual Social and Economic Supplement (CPS ASEC)*, a report released by the U.S. Census Bureau, in 2014, the official poverty rate was 14.8 percent which means there were 46.7 million people in the US living in poverty. Low-income or students living in poverty face even greater challenges in their efforts to obtain a college degree. Low-income students typically come from non-college educated families and are typically first-generation college students from families where neither parent had more than a high-school education. Most of the low-income students tend to face a number of obstacles, such as poor academic preparation in high school, inadequate finances, reduced educational degree expectations and plans, a lack of appropriate role models or mentors, and a lack of support from peers or family members [9]. If this trend continues, we will see more of an economic divide between the poor and the middle class in America.

All of these factors are deterring factors for students wishing to pursue a STEM discipline degree. The question then becomes, how can we change this growing trend? The School of Technology at North Carolina A&T State

University recognized the critical importance of increasing the pipeline of low income academically gifted female students in the STEM fields and created a program, The Females in Technology (FiT) Summer Boot Camp to directly confront these challenges. The 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 women [10]. 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 [11, 12]. The FIT Summer boot camp proposal focused on recruiting and mentoring low income female high school juniors and senior students in NC to pursue careers in Science, Technology, Engineering and Math. The objective of the Summer FIT boot camp was to increase the number of low income female students who pursue degrees in technology disciplines on the collegiate level and who are prepared for a technologically rich workforce.

II. DEMOGRAPHICS

In order to fully understand the rational for this program, the demographic should be examined. NC A&T State University is a Historically Black College and University with a STEM Early College High School located within the School of Technology. Over 85 % of the student population is African American. NC A&T as a whole had a 54% female undergraduate student body, but in the School of Technology only 23% were female. This gave us a unique position to make a paradigm shift more reflective of the University's student body population. The School of Technology's (SoT) degree programs are the focal point for the FiT program, which centers on preparing the students for technical careers. The School is a fully accredited by ATMAE and has departments including Computer Systems Technology, Built Environment, Graphic Communication Systems, and Applied Engineering Technology. The School also offers 10 undergraduate and graduate degrees, educating over 800 students annually (see table 1).

The school began to see a decrease in enrollment in fall 2010. 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 from 2006- 2011 more than 30% (a drop from 270 to 189). As the school aims to increase the enrollment, admissions in the School of Technology for Fall 2013 is up 32% from last year (120 admits as compared to 81 admits for fall 2012). However, the numbers for female enrollment is still disproportionally low at only 23%.

TABLE 1: RACE AND GENDER DEMOGRAPHICS OF SOT STUDENTS

Department	Race	Year															
		Fall 06		Fall 07		Fall 08		Fall 09		Fall 10		Fall 11		Fall 12		Fall 13	
		F	M	F	M	F	M	F	M	F	M	F	M	F	M	F	M
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**

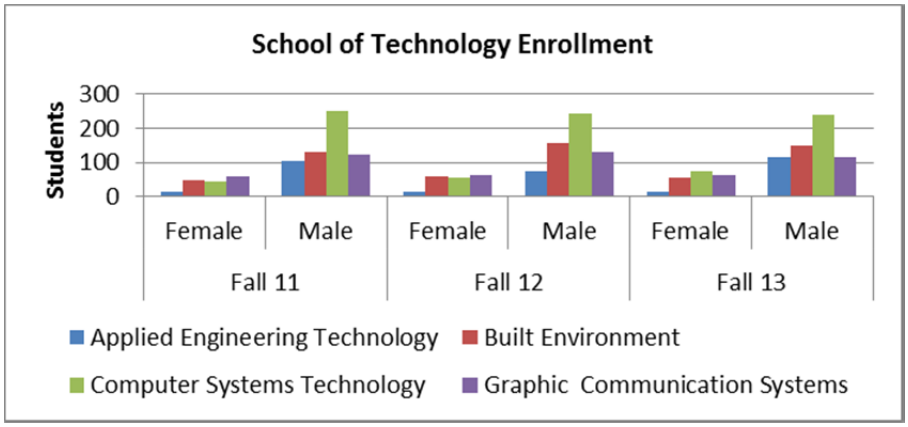

Figure 1: Student Enrollment in SoT

III. PROGRAM DESCRIPTION

The objective of the FIT boot camp is to broaden participation of low income females in the technology careers. The boot camp is used to recruit and mentor low income high school females into the technology field. There are two anticipated outcomes from using the FIT Boot Camp to stimulating interest in STEM for low income females:

1) Students from the program will pursue STEM careers. This is an all-encompassing goal. Did this program broaden participation for women in the STEM field in any form? Did the students attend a technical school, STEM base position in armed forces, other university in STEM degree program, technical certificate program, etc.?
2) Students from this program will enroll in North Carolina A&T State University and pursue a degree in technology. This is the ultimate goal of the program. Did the student enroll or express desire to enroll in North Carolina A&T State University's School of Technology?

After reviewing our findings, we believe the 2015 FiT program achieved these objectives by creating a program that is specifically designed to offset inherent disparities in career preparedness between income levels through enhancing discovery and understanding for the technology field at large by 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 methodology for the FiT Boot Camp was a short-term intensive hands-on experience to stimulate interest and motivate students to pursue technical careers. In "Hands-On Summer Camp to Attract K-12 Students to Engineering Fields" by Yilman et al, studies showed that STEM related summer camps were successful at increasing awareness, improving self-confidence and students interest in STEM fields [11] Their findings also show that hands-on exposure resulted higher success rates for interest and overall satisfaction. All of the tech sessions in the boot camp were hands-on which allowed the participants the opportunity to gain experience with some of the latest technology. Another study entitled "Impact of Robotics and Geospatial Technology Interventions on Youth STEM Learning and Attitudes" authored by Nugent et al, examined the different benefits of intensive vs. short term summer camp experiences. While intensive proved to be most successful with greater learning outcomes, short term proved most successful with stimulating interest in STEM [13]. The FiT Summer Boot Camp couples the three methodologies to create a hybrid effect to achieve our desired outcomes. Thus a short-term intensive hands-on approach is introduced. The agenda shows two full days of hands-on activities for the boot camp. This methodology is the first of its kind for projects at North Carolina A&T State University. The simplistic nature of the FiT Summer Boot Camp fosters a model that can be easily replicated for any program with similar objectives.

IV. PROGRAM IMPLEMENTATION

A program announcement flyer was used as the main source of advertisement for the camp. The announcement was posted on the School of Technology's website, North Carolina A&T State University's Summer Programs website, as well as social media. The program flyer was also distributed during Aggie Nights; the university's traditional recruitment fairs in popular areas such as Georgia and Maryland. We will utilize the Office of Student Success in the School of Technology services to share information about this project with state wide high schools. With over 456 public high schools in North Carolina, the Office of Student Success has created partnerships with over 150 of those high schools. Most of our recruiting efforts were in the more densely populated areas of NC which includes: Charlotte-Mecklenburg, Piedmont Triad and Piedmont Triangle. A program announcement was sent to high school counselors about the Females in Technology Summer Boot Camp and they were asked to recommend students that meet the criteria and post announcement in highly visible area for prospective participants to see (many high schools have announcement boards that share information about college preparation and recruitment). After which, interested applicants went to our website to download application and instructions. The eligibility requirements and application instructions were as follows:

- Meet income requirement (free or reduced lunch).
- Minimum 3.0 GPA.
- Meets requirements to graduate from high school.
- US citizen.
- **Essay:** A statement of career interest in technology and how this program will benefit you in making your future career choice. The essay must be 200 words or less, 12 point font, Times New Roman, and doubled spaced.
- **Transcript:** An official copy of your school transcript must be submitted with the application showing your cumulative grade point average. We realize that your last grading period (June) is not available. An attendance report must also be included with your transcript.
- **Letters of recommendation:** Two letters of recommendation must be included. The letters must be type-written on official letterhead or "8 ½ x 11" white paper (notebook paper is not acceptable). One of the letters must come from a representative of your school; the second letter may be written from someone who can speak about your character from the community.

The PI, Project Director and Faculty Advisory Board ranked applications and selected the top 15 applicants in terms of GPA, letters of recommendation and essay. The Engineering Technology Division Mini grant provided funds for ten participants and Absonutrix funded five. Nine of the participants were rising high seniors and six were rising high school juniors.

The agenda below shows the participants' three day schedule. There were five technical sessions and one technical field trip. The theme of the camp was to introduce the participants to different majors and degree offering in the School of Technology in a fun and non-traditional manner to stimulate interest.

V. TECHNICAL SESSIONS

The "Post to Be" technical session showcased our Graphic Communication Technology department. In this session, participants created posters using Adobe Illustrator software. The posters included a quote which required typography skills. Typography is the art and technique of arranging type to make written language legible, readable, and appealing when displayed. The participants also used Adobe Photoshop software to manipulate a photo and then transfer it back to the original quote to complete their poster.

TABLE 2: FIT SUMMER BOOT CAMP 2015 AGENDA

Time	Activity/Program	Responsible	Audience/Participants	Location
Friday, July 10, 2015				
7:30 a.m. - 8:30 a.m.	Check-in		FIT Participants	Aggie Village
9:00 a.m. – 9:50 a.m.	Welcome Session	Evelyn Sowells	FIT Participants, SOT Students, University, and External Community	Smith Hall Lobby
10:00 p.m. - 11:30 a.m.	**Tech Session "Post to Be"**	Jasmine Ellerbe Paige Bostick	FIT Participants, SOT Students, University, and External Community	4009 Smith Hall
Break 11:45 p.m. – 12:45 p.m. Lunch in Dining Hall				
1:00 p.m. - 3:00 p.m.	**Tech Session Robotics**	Edmonson Effort	FIT Participants, SOT Students, University, and External Community	4016 Smith Hall
3:15 p.m. - 4:00 p.m.	Info Session	Daniel Mountjoy		4016 Smith Hall
Break 4:30-5:30 Dinner in Dining Hall				
5:45 p.m.-7:45 p.m.	**Tech Session "Is there an App for that?"**	Gina Bullock	FIT Participants, SOT Students, University, and External Community	3009 Smith Hall
8:30-10:00 p.m.	Pajama Party	Jasmine Ellerbe Paige Bostick	FIT Participants	Aggie Village
10:00 p.m.- 7:00 a.m.	**Curfew**			
Saturday, July 11, 2015				
8:00 a.m. - 9:00 a.m.	Breakfast		FIT Participants	Smith Hall Lobby
9:15 a.m. - 11:45 p.m.	**Tech Session Conception Technology**	Lewis Waller	FIT Participants	3018 Smith Hall
Break 12:00-1:00 Lunch Dinning Hall				
1:15 p.m. - 3:00 p.m.	**Tech Session Robotics**	Edmonson Effort	FIT Participants, SOT Students, University, and External Community	3009 Smith Hall
4:00 p.m. - 5:00 p.m.	Let's Build Green Tour	Andrea Ofari-Boadu	FIT Participants, SOT Students, University, and External Community	Proximity Hotel
Break 5:15 p.m.-6:15 p.m. Dinner in Dining Hall				
7:30 p.m.- 10:30 p.m.	Field Trip	SOT Faculty and counselors	FIT Participants, SOT Students, University, and External Community	Spare time
10:45 p.m. – 7:00 a.m.	**Curfew**			
Sunday, July 12, 2015				
8:00 a.m. – 9:00 a.m.	Breakfast		FIT Participants, SOT Students, University, and External Community	Smith Hall Lobby
9:00-9:30	Program Evaluation			Smith Hall Lobby
9:30 a.m.-10:00 a.m.	Closing Session	Sherry Abernathy		Smith Hall Lobby
10:00 a.m. – 11:00 a.m.	Check-out		FIT Participants	Aggie Village

The robotics and “Is there and App for that” tech sessions represented course studies in the Computer Systems Technology department. The robotics session used open source software to teach the FiT camp participants about the basics of electrical circuits and an educational programming language named Scratch; the raspberry PI software ran simulations of Scratch code to control a robot as the final project for the students.

In the mobile application session, participants learned technology by building socially useful mobile apps. In addition to programming, the activity was project-based and emphasizes writing, communication, collaboration, and creativity. The first App project: Part 1 walks students through building an app with a moving ball that bounces off when it comes to an edge. Part 2 introduces buttons to change the ball's speed. This is an excellent introductory lesson for students because it allows them to observer the immediate effects of their program changes in the app's behavior. We also included an option that teaches students about if-statements by guiding them on how to build a calculator app. The second App project guides students through uploading media (sounds, pictures, videos, etc.) to their phone by building the classic App named Inventor app: Dog. Part 2 of Inventor app guides students through the Speak app event teaching them about Events. Participants learn about using the Clock's Timer functionality by using the MoleMash tutorial. In the game MoleMash, a mole pops up at random positions on a playing field, and the player scores points by hitting the mole before it jumps away. The third app: Create an app that will let you play sounds with a tablet. Participants create image sprites and when the image sprites are touched they will play a sound. Participants can also tilt the tablet to play the sounds using the accelerometer.

The Conception Technology and “Let’s Build Green Tour” sessions introduced the participants to degree programs in the Department of Built Environment. The Conception Technology covered topics in Construction Technology and Building Concepts. The participants formed teams and the activities objective was to see which team could build the most functional and sturdy office space out of simple materials. The Conception Technology session was an active learning and involved collaborative learning components. Two female Construction Management (CM) professionals (graduates from the CM program) shared in-depth knowledge regarding their roles in the construction industry. Basically, they explained how the knowledge and experience gained from their education as students from the Built Environment enhanced their performance in the construction industry as Project and Field Engineers. Also, stating from their exposure with different construction workshops and meetings that there is a growing trend for females in the construction industry. Additionally, they placed emphasis on the skills which are needed to be successful in the construction technology field. These included critical thinking, creativity, detail oriented, excellent leadership, and a thorough understanding the business aspects of this industry.

The participants also focused on the basic engineering principles and technical skills needed by CM professionals. The Construction Management professionals also explained that most of the projects which they had been a part of consisted of commercial and industrial buildings and it was vital that they understood the importance of teamwork, interaction with tradesmen, and project management.

After informing the high school females about construction technology, the students were introduced to their group activity. The construction activity involved the implementation of active learning techniques whereby the graduate elaborated on various construction techniques, estimating, building materials, building codes, planning, scheduling and reading of blueprints. Once the lesson was presented to the high school students, they were teamed up in in groups of four and one of them became the leader of the team. In the group activity, the students were given a basic blueprint whereby they were shown how to construct the framework of a building. The group leader worked with the industry professionals to gain more detailed information about the assembly procedures for constructing the framework. The assignment was competiveness and each group was evaluated based on the level of expertise demonstrated in estimating building materials and constructing the building.

The students worked on the project for one hour and upon completion of the structure they had to present their findings to their peers. Each member of the group explained their input in constructing the small framework. The students basically stated that the project allowed them to gain knowledge about construction drawings, reading architectural scales, laying out walls with accuracy and detail, and learning about the different wall parts. Furthermore, they stated that they had gained knowledge in the latest trends in the construction industry from their interaction with the industry professionals. Briefly, they indicated some interest in that the Construction Management program and were excited about the different types of construction technology and the processes involved in building an office block.

The “Let’s Build Green” field trip took the participants on an eco-friendly tour of the nation’s first green Platinum LEED Certified Hotels. During the tour, participants learned about leadership in energy and environmental design, sustainably, and reduced building operating cost. The main objective of the FIT ‘green building’ field trip to the Proximity Hotel was to expose female students to sustainable technologies used in green buildings. The Proximity Hotel is a green building which was designed and constructed to follow the standards of the Leadership in Energy and Environmental Design (LEED) Green Building Rating System. The Proximity Hotel is a LEED Platinum "green hotel" because it met all the perquisites and performance benchmarks necessary to earn the Platinum rating.

The field trip lasted approximately one hour, starting off at the lobby of the Proximity Hotel. The tour guide led FiT participants through interior spaces and outdoor

environments. These spaces included the gym, restaurant, bedrooms, swimming pool, rooftop and outdoor dining areas. In each space that the participants toured, the tour guide showed and explained specific LEED standards and practices implemented at the Proximity Hotel. Examples included but were not limited to the following: (1) 100 solar panels covered 4,000 square feet of rooftop and the panels were used for water heating; (2) 700 linear feet of stream were restored by reducing erosion and planting local, adaptable plant species; (3) Geothermal energy was used for restaurant refrigeration equipment; (4) Abundant natural lighting was provided through large energy-efficient operable windows; (5) Water consumption was reduced through high efficiency Kohler plumbing fixtures; (6) Building materials with recycled content used during construction included steel with 90% recycled content, gypsum wallboard (100%), asphalt (24%), staircase steel (50%), and concrete contained 4% flash; (7) 87% of construction waste was recycled during the construction phase; (8) Low-emitting volatile organic compound paints, adhesives, carpets were used to improve air quality; (9) regional vendors and artists were used for material supplies; and (10) bicycles were available for guests to ride on the nearby five-mile greenway.

The FiT participants were very engaged during the tour. They asked lots of interesting questions. Also, the very opportunity to be in a hotel environment seemed to excite these FiT participants. The main objective of the FIT 'green building' field trip to the Proximity Hotel was to expose female students to sustainable technologies used in green buildings. During the tour, participants learned about leadership in energy and environmental design, sustainably, and reduced building operating cost. Pre-tests and post-tests demonstrated that FiT participants had gained some new knowledge from this FiT green building field trip.

VI. PROGRAM EVALUATION

Pretest, posttest and surveys we given to participants for assessment of the program. Each technical session had pre and post test questions to evaluate knowledge gained. There were also a pre and post questionnaire about attitudes towards technology which allowed us to investigate outcome achievements. A final survey was collected from the participants to evaluate the overall functioning of the camp. The table below shows results from the final survey. 53% of the participants rated the program good or very good and 40% rated the program excellent. While 93% of the technical session leaders received a rating of good or very good.

There were also general questions ask about what they like most and areas of improvement for the camp. After assessing the comments, it is clear that we did achieve our objective of stimulating interest in technology for our participants. We were also able to assess which tech sessions were most enjoyable and what we should do to improve the program. The Robotics, Construction Management and App development were among the participants favorites. We found that the intensive schedule could be improved to allow longer breaks during the day. Some of the activities ran over the allotted time which caused timing conflicts for other schedule tech session. I believe this can be remedied next year by adding an extra day. Most of participants express that they wanted the program to last longer.

TABLE 3: PROGRAM SURVEY

Overall ratings of program				
Poor	Fair	Good	Very Good	Excellent
0.0%	6.7%	26.7%	26.7%	40.0%
Overall ratings of speakers				
Poor	Fair	Good	Very Good	Excellent
0.0%	6.7%	60.0%	33.3%	0%

Technology Interest

The final assessment for the program was evaluating attitudes toward technology. Table 4 below shows results. Questions 1, 2, 3, 6, and 7 examined the participants overall perception of the technology field. The question then became, did we stimulate interest in technology? The survey showed an average of 30% positive change in attitudes about technology. The next area of evaluation was "Are participants more likely to pursue technical degrees?" Questions 3-7 all showed a positive change with the exception of one participant that stated that they did not want to attend college. Unfortunately, none of the follow up questions examined after high school plans for participants. Questions 9-11 were general questions assessing self-efficacy in participants. The pre camp survey suggested that as opposed to many research findings that suggest that there are low numbers of women pursuing technical degrees because women feel that they are not as technically equipped or inferior to the opposite sex when it comes to science, math, technology and engineering; The FiT participants believe that they're just as good or better than their male counter parts. The ultimate goal to increase the number of female who enroll in the SoT was also assessed. Question 5 evaluated whether the participant enrolled or expressed desire to enroll in North Carolina A&T State University's School of Technology? Here, we saw a 26% positive change. This positive trend indicated that several of the participants will enroll in our technology degree programs. As of the date, five of the nine seniors, 55% of the participants eligible for college enrollment by fall 2016, have applied to North Carolina A&T. Out of the five that applied, four (44%) applied to STEM degree programs and three of the four (33%) have applied for admittance to the School of Technology.

TABLE 4: TECHNOLOGY PERCEPTIONS AND ATTITUDES

Q1: I like to use technology						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	6.7%	0.0%	6.7%	6.7%	80%	
Posttest	0.0%	0.0%	0.0%	0.0%	100%	**20%**
Q2: I understand what technology is						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	13.3%	13.3%	53.3%	20%	
Posttest	0.0%	6.7%	0.0%	33.3%	60%	**40%**
Q3: Technology is a good field to work in						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	13.3%	13.3%	26.7%	47%	
Posttest	0.0%	0.0%	0.0%	26.7%	73%	**46%**
Q4: I want to attend college						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	0.0%	0.0%	0.0%	100%	**-7%**
Posttest	0.0%	0.0%	0.0%	6.7%	93.3%	
Q5: I want to attend A&T						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	13.3%	13.3%	46.7%	13.3%	13.3%	
Posttest	0.0%	0.0%	60.0%	26.7%	13.3%	**26%**
Q6: I want to major in technology						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	13.3%	13.3%	40.0%	26.7%	6.7%	
Posttest	0.0%	0.0%	66.7%	26.7%	6.7%	**26.7%**
Q7: People who major in technology have good jobs						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	0.0%	6.7%	33.3%	60.0%	
Posttest	0.0%	0.0%	0.0%	20.0%	80.0%	**20%**
Q8: College is hard						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	0.0%	33.3%	46.7%	20.0%	
Posttest	0.0%	26.7%	26.7%	33.3%	13.3%	**26.7%**
Q9: Going to college is a good investment in my future						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	0.0%	0.0%	0.0%	0.0%	100.0%	
Posttest	0.0%	0.0%	0.0%	0.0%	100.0%	**0%**
Q10: Studying technology is really for boys						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	93.3%	0.0%	6.7%	0.0%	0.0%	
Posttest	93.3%	0.0%	6.7%	0.0%	0.0%	**0%**
Q11: Boys are better at Science, Technology, Engineering and Math than girls						
	Strongly Disagree	**Somewhat Disagree**	**Neutral**	**Somewhat Agree**	**Strongly Agree**	**Gain**
Pretest	86.7%	6.7%	6.7%	0.0%	0.0%	
Posttest	93.3%	6.7%	0.0%	0.0%	0.0%	**6.7%**

Keep in mind that 2015 was the inaugural FiT summer boot camp program. Therefore, ongoing evaluations are needed for impact of new learning. Semi-annual surveys are sent out to all participants to follow their career trajectory. This allows for a control group, the participants enrolled at NC A&T and a comparison group, those who did not enroll. For future camp assessment purposes, we plan to adopt other methodologies, such as social media to obtain feedback for continuous program improvement.

When you couple the low income, female and STEM college degree graduates demographic, the statistics are disproportionately low. With only 9% of all low income students graduating from college [14] and 51% of them are women[15]. This equals 4.5% of the population. Now let's consider that less than 10% of the 4.5% will pursue a STEM degree equaling 0.45% or less than a half of a percent of the population. The numbers become even more alarming if week include minorities.

The effectiveness of the programs ability to recruitment this particular demographic into technology careers is reflected by meeting 55% of the overall program objective outcomes, recruitment into STEM degree programs. We are continuing to study our methodology, short-term intensive hands-on approach which fostered the overwhelming success of the program; as well as continuous program improvements drawn from literature and participant feedback.

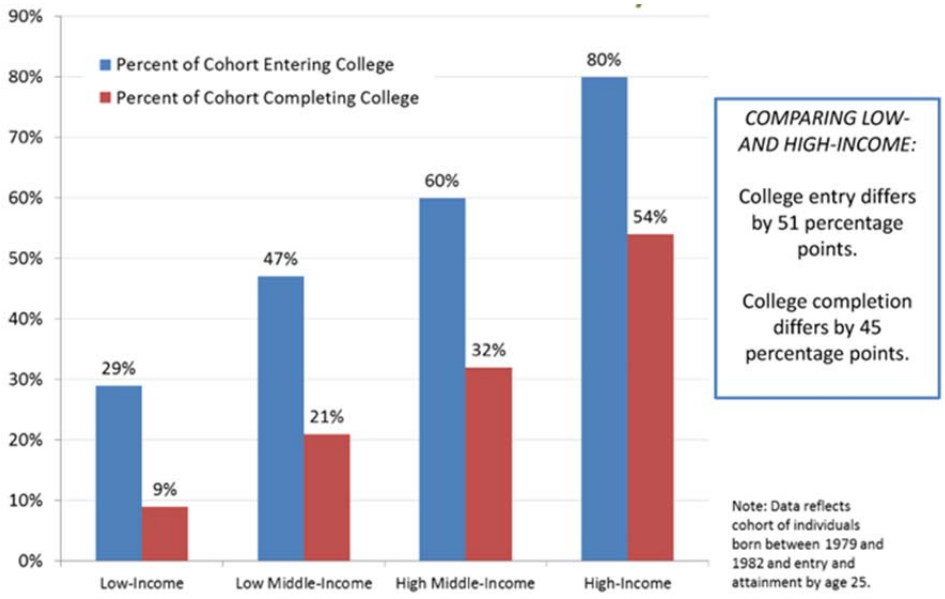

Figure 2: U.S. College enrollment and completion rate with family income [14]

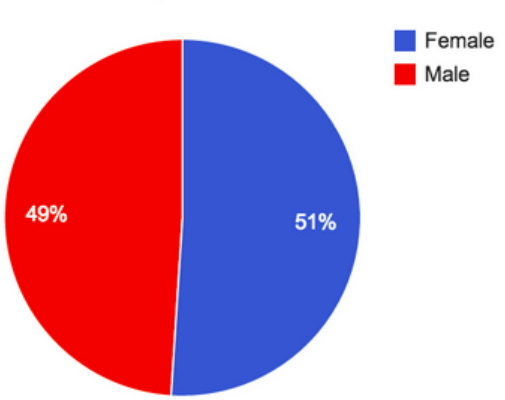

Figure 3: Bachelor's Degrees conferred 1970-2012 [15]

VII. CONCLUSIONS

Pre-college recruitment is critical to build young women's involvement and confidence in technology [10], and also establishes the value of mentoring and a supportive environment for diverse low income students [16]. 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 [17].The methodology for the FiT Boot Camp was a short-term intensive hands-on experience to stimulate interest and motivate low income academically gifted female students to pursue technical careers. In "Hands-On Summer Camp to Attract K-12 Students to Engineering Fields" by Yilman et al, studies showed that STEM related summer camps were successful at increasing awareness, improving self-confidence and students interest in STEM fields [11] Their findings also show that hands-on exposure resulted higher success rates for interest and overall satisfaction. All of the technical sessions in the boot camp were hands-on which allowed the participants the opportunity to gain experience with some of the latest technology. Another study entitled "Impact of Robotics and Geospatial Technology Interventions on Youth STEM Learning and Attitudes" authored by Nugent et al, examined the different benefits of intensive vs. short term summer camp experiences. While intensive proved to be most successful with greater learning outcomes, short term proved most successful with stimulating interest in STEM [13]. The FiT Summer Boot Camp coupled the three methodologies to create a hybrid effect to achieve our desired outcomes. Thus a short-term intensive hands-on approach is introduced. The agenda summer camp agenda outlines two full days of hands-on activities for the boot camp. This methodology is the first of its kind for programs at North Carolina A&T State University. The simplistic nature of the FiT Summer Boot Camp fosters a model that can be easily replicated for any program with similar objectives. The camp also introduced female participants to new and innovative technology concepts while reinforcing and improving technology and leadership skills by creating a program that is specifically designed to offset inherent disparities in career preparedness between income levels through enhancing discovery and understanding for the technology field at large by 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.

After reviewing our findings, we believe the FiT program achieved the objectives of stimulating interest and recruiting more academically gifted low income females into the technology profession. To date, five of the nine seniors, 55%

have applied to North Carolina A&T State University. Out of the five that applied, four (44%) applied to STEM degree programs and three of the four (33%) have applied for admittance to the School of Technology. Four of the junior participants have express desire to return in 2016.

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