

In the sixth grade, I was separated from my “normal” reading class and placed in a class for the talented and gifted, aptly named TAG, with six of my Caucasian peers. Upset and lonely culturally, I begged my mother to put me back with my friends where I thought I belonged; the begging was in vain as I remained for two years in a class that was designed to challenge and push me academically and socially. As a result of the class, I began to seek after challenges and desired to be different amongst my friends. Though most of my friends despised math, I was innately proficient and adored it. With my love for math, coupled with my infatuation with any type of technology, I sealed my fate as early as the seventh grade; I knew I would be a computer engineer. In May 2013, I received my Bachelor of Science in Computer Engineering from North Carolina Agricultural and Technical State University, becoming one step closer to actualizing my twelve year-old dreams. However, throughout my matriculation as an undergrad, I realized that my goal was bigger than becoming an engineer; I wanted more African American and female twelve year olds to share my dream. It was my research and tutoring experiences that led me to pursue a PhD in Human Centered Computing with the intent of increasing the quantity of African Americans and females in the STEM field by intertwining my loves of math and the arts.

My research began as a participant in the NSF sponsored North Carolina Louis Stokes Alliance for Minority Participation (LSAMP) program. This program’s goals are aligned with my own; it aims to amplify the quality and quantity of underrepresented groups in the STEM field pursuing graduate studies. Under the advisement of Dr. Christopher C. Doss, I worked for a year and a half with the Tutalege program. Tutalege is a program designed to combat the low retention rate of students entering historically black colleges and universities (HBCUs) by using active learning to engage students and assess their comprehension. The program is devised to allow students to practice subject matter questions primarily on mobile devices. Initially, I focused on the server side of the program; we proposed to have the server send questions to the client’s device using the MySQL database system. By the end of the semester I was able to update the database on the server from the client using socket programming.

During my senior year, I switched my focus to another aspect of the Tutalege project. I worked alongside another student to develop the client side of the system. I used XML to transfer the data (question, answer choices, possible images/audio) to the client. I found that Base64 is a common encoding/decoding method that makes it possible to send images via XML files. Base64 encoding splits the data into three bytes and converts them to four six-bit numbers. These numbers are then converted to their equivalent ASCII character. The process is then reversed when received by the client and displayed in its media form. We were able to present our progress at the NC OPT-ED Alliance Day at North Carolina State University, along with others with in the NC-LSAMP program in October 2012.

It was under Dr. Doss’ instruction that I also was introduced to Android programming. In his class, each student created a mobile application using the Eclipse IDE and various emulators. I chose to create the “BrainiApp.” My application was targeted for children ages three to five. I took notice at how the much younger generation was quickly becoming familiar with mobile phones and decided to use this as an opportunity to educate them early. The app consisted of five different subject areas: Colors, Alphabet, Shapes, Numbers, and Words. The user could select any of the five categories and was shown an image, a question and a set of multiple choice answers. Upon selection of the right answer, a new question from the same category would generate. The user could quit at any time and return the opening menu to select a new category. The app also featured a music player on the welcoming screen that could be muted or unmuted.

I further applied the research and development skills learned from Dr. Doss and the LSAMP program when I was participant in the Summer Undergraduate Research in Engineering/Science (SURE) program at Georgia Tech during the summer of 2012. SURE aims to increase the number of minorities interested in graduate studies by exposing these students to research opportunities. I worked under the advisory of Dr. Ayanna M. Howard in the Human-Automation Systems (HumAnS) Lab within the School of Electrical and Computer Engineering. The goal of my project was to create a low cost virtual reality simulator for training medical students on the cholecystectomy, the gall bladder removal surgery, at Grady Trauma Hospital. The project was developed due to the recent rise in using virtual reality in simulating surgical procedures and the positive effects it has had in improving surgical skills.

This inexpensive simulator incorporated the use of the Microsoft® Kinect for Windows' motion sensors, which monitored the user's movements, and the Nintendo® Wiimote, which generated haptic feedback. The system guided the user through five steps important to the procedure with on-screen directions and visual, as well as haptic, feedback when each task within the step was completed. The Wiimote vibrated when the tasks were accomplished and also functioned as the surgical instrument, changing its image visually depending on what was needed for each stage. The C# programming language was used for coding because there was a library for the Wiimote written in this language. My research proposal will show how I intend to use my familiarity of the Kinect to get younger students excited about STEM fields.

During my senior year, I worked with a team of three other female students in the Electrical and Computer Engineering department, under the advisement of Dr. John C Kelly, Jr., the department chair, to complete our Senior Design course. During the fall semester, we were required to complete a mini-design project that would be a component for our larger design project due in the following semester. Our group's overall project was a handheld color matching device, the "ColorMe," that was designed to detect the proximity of two different colors via their RGB values. The technology would be useful in assisting interior designers and/or the average shopper. For the mini project, we decided to construct a battery charging circuit that would fit into the device. The circuit featured a button to start or stop the charging, a voltage sensor to measure the existing voltage, a voltage regulator, a current sensor and another voltage sensor to ensure that the correct amount of voltage would be distributed to the battery. Our circuit charged the battery by sensing the existing voltage of the battery and regulating the voltage being produced so that the battery will receive a maximum of 4.2 volts per cell. We chose to use lithium polymer-ion batteries based on their low discharge rate, high specific energy density and small size.

The ColorMe was able to capture a color's RGB values, store the values and compare them to either a new color or a previously stored color. The device was composed of a ColorPal color/light sensor, an Arduino Uno, a TFT Touch Shield (Screen) for Arduino, and the charging circuit. I was primarily responsible for the programming of the Arduino during the second semester. After deriving a calibration equation, our team concluded that while the ColorMe was able to distinguish different colors from one another, the resolution of the ColorPal sensor was too low to detect noticeable differences between shades of one color.

I continued to work to help create technology designed to help others as I transitioned into my pursuit of my doctoral degree at Clemson University, under the advisement of Dr. Juan E. Gilbert. I am currently a member of a project that aims to study gestural interaction in order to create a television interface. This project seeks to enable a wider range of television users, including those with limited mobility, to access their devices with the use of gestures. A user

study was completed in Spring 2014 to detect the most commonly used gestures to control over 20 functions on a smart television. The study was simulated using the Wizard of Oz method, where on researcher controlled a Powerpoint presentation that mimicked the response of an actual television once the study participant completed their gesture. The team, now at the University of Florida, are currently designing the interface as well as implementing the system.

As I reflect on the idea of training younger students early in programming, I realized that my passion for encouraging and educating younger minds began in high school when I began a praise dance team for the youth (ages 4-11) at my church. I continued to work with children throughout my matriculation at NC A&T as a member of the Honors Program, the assistant treasurer of the National Society of Black Engineers (NSBE), the programs chairperson of the Institute of Electrical and Electronic Engineers (IEEE) and as a tutor. I was required to participate in the Honors Program as a stipulation of being a Lewis & Elizabeth Dowdy Scholar, which provided me with a full scholarship. As an Honors student, I was provided the opportunity to work with Operation Homework; this program offers free tutoring to elementary and middle school students at a local church.

Tutoring and working with younger children has always been a joy to me. My membership with NSBE allowed me to participate in Pre-College Initiative Day. This event welcomed hundreds of middle and high school students to our campus for an all-day program that introduced them to different aspects of engineering with hands-on engineering activities. For two years, I was on-campus tutor for the Center of Academic Excellence, where I served students taking mathematics and chemistry courses. The intrinsic reward that I received when a student successfully solves a problem or finally has that “Aha!” moment has motivated me to do my part to increase the presence of minorities in the STEM fields. Though there has been progression, the number of minorities in engineering is low. In 2010, only 4.1% of approximately 80,000 students earning bachelor’s degrees in engineering were African American. This low percentage of participation could be a result of numerous factors including lack of awareness, lack of interest, poor academic preparation, and/or lack of motivation. I have also served as a tutor in a public school system, which predominantly consisted of African American students who were primarily from low-income families. The happiness and enthusiasm the students displayed when they were able to complete a simple math problem, after a little push, showed me the difference a small amount of encouragement made. After I become a professor, I desire to establish non-profit STEM centers for underprivileged minority youth.

I plan to name my non-profit STEM centers DREA(M)<sup>2</sup> TEAM (Developing Richly Educated and Ambitious Minority Minds by Teaching Engineering and Mathematics) and provide homework help, in addition to offering stimulating hands-on math and science activities. Outside of the intended purpose of getting minority youth more interested in the STEM field, I also want the centers to serve as safe havens, where kids want to come instead of feeling forced to come. I intend to use these centers as beacons, within communities where the minorities are the majority, that will introduce young people to the branches of STEM and give the youth a motivating ‘push’ to enter the fields of science, technology, engineering and math.

I believe that I am an exceptional candidate for the National Science Foundation Graduate Research Fellowship. My aspirations and objectives align with the goals of the foundation. I am ardent about increasing the quantity of African Americans and women interested in the STEM field. With my determination and the funding provided by NSF, I will be able to reach out to these minority groups and hopefully modify the statistical makeup of scientists, engineers and mathematicians.