

Morehouse College NASA Swarmathon Robotics Team

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Purpose:

The purpose of this outreach was to encourage minority students to enter into the science, technology, engineering, and mathematics (STEM) field. One of the biggest reasons why there is a lack of diversity in the STEM fields here in America is due to the lack of exposure. Furthermore, those few minority students who actually love STEM and are into it rarely have access to it. For those reasons amongst many others, our outreach team main objective was to show students of color how fun and exciting projects such as robotics could be.

Goal of Project:

The NASA Swarmathon gives students from all backgrounds who are interested in robotics an opportunity to develop and apply new skills as an engineer. This outreach opportunity allows Swarmathon teams to continue this trend by using their knowledge of robotics to further develop and cultivate the interests of younger students in field of engineering. Our goal in helping Brown Middle School's student was multi-faceted. Our overarching goal was to aid in the design of a drone that was going to be used for the G3 Drones for Good competition held by Motorola. This competition pitted 20 middle schools against each other to see who could construct the best drone. Drones were scored on their ability to fly through an obstacle course, where each successful flight scored 40 points. We assisted mostly on the construction of the drone's frame. The frame not only had to be sturdy enough to endure impact from relative high altitude, but also formed in such away so that it could smoothly contort its way through the competition's obstacle course. Another goal was to teach the students how to effectively fly the drones. With the few practice drones everyone built, we made sure that the flyers of the drones were able to skillfully hover, land, and maneuver through the air. The final goal of the project was to calibrate and program the drone to its controller.

Relation to Robotics:

The project related to robotics in a plethora of ways. The drone itself being a robot, our team had to use the same engineering process to create a drone for the students that could highly compete seeing as there were a lot of teams in the competition. Therefore, the ideation, design, and assembly process that was applied to the drones is the same type of thorough process one would use when creating robots. Additionally, the programing of the drone to its controller is an analogous process to that of programming a robot to its controller. All in all, because one can strongly argue that a drone is indeed a robot in itself, our Brown Middle School outreach project was purely robotics.

Equipment:

The equipment that was used to build the drones included plastic propellers and four Lumenier MX2206-9 2450KV Motors. This motor was chosen for its robustness and frugality given the restricted budget. The frame of the drone was composed of toy connectors because they were able to carry a large amount of weight without bending or breaking. The motors were powered by a 9V battery that connected to an Arduino. The controller that was used to maneuver the bot an ordinary drone controller found at a Micro Center retailer.

Target Demographic:

Many students currently in middle school and possibly even high school have had a formal introduction to how STEM can transform their careers. In an article by *Popular Science*, Chris Ransom wrote,

In the end, we can't expect people to choose careers in science and technology simply because they should—or because that's where the jobs will be. They will make a life in those fields only if they are excited and empowered to do so.

Part of becoming empowered in STEM is having more experienced researchers training younger researchers who will be the next-generation of STEM job holders. There is one problem students find with this model however. Students in middle school, who have the potential to go into STEM careers, oftentimes have difficulty thriving in STEM because their trainers do not match their demographic.

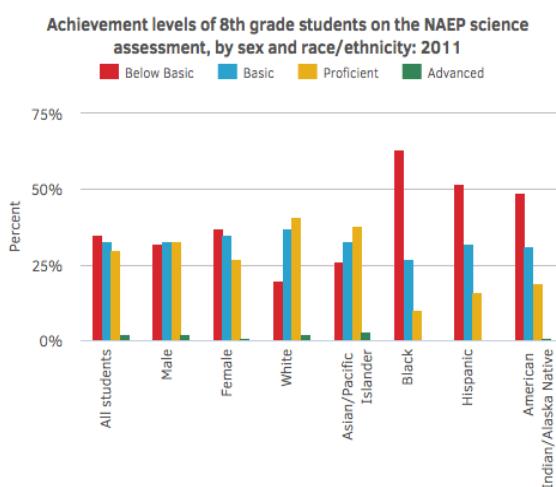


Figure 1.A: This plot displays how 8th graders of various demographic backgrounds scored on the National Assessment of Educational Progress in

One reason that Brown Middle School was selected for this outreach opportunity was because the students on the robotics team were all young African American 8th graders. Currently we live in an era where African Americans are among the most marginalized groups in STEM careers. In fact, Black and African Americans comprise only 8.6 percent of computer and mathematical occupations (U.S Department of Labor). However, if we assess the proficiency level of African Americans in science in the 8th grade (Figure 1A.), we can see a noticeable gap between them and other demographics of students. This brings to question if training individuals to become empowered by STEM has a relation to the

achievement gap in African American 8th graders and is the root cause of why we selected to engage with Brown Middle School.

Another reason why Brown Middle School was selected was because the robotics group was composed mostly of girls. In total, five girls and two boys were on the team. Again, if one analyzes *Figure 1A.*, he or she will see compared to boys, 8th grade girls do not achieve as high of marks in science and math. Additionally, women are vastly unrepresented professionally according to a study in 2016 by the Department for Professional Employees in computer, math, and engineering (only 15.1% in engineering, and 24.7% in computer/math). Finally, we met with Brown Middle School's Robotics team because we wanted to be models that come from the same demographic that these students might need to stay in the STEM field.

Future Work:

The experience with working with each of the students was hands on and interactive. It offered a great way to become involved with younger students of the community. Morehouse College Swarmathon members were able to serve a great role models for Brown Middle School's students. This relation allows us to continue work with the Brown Middle School Robotics Team. We will now begin to work with them on their submarine drone project and competition which is held in May. This is a project where they have to construct an apparatus that will be able to be controlled remotely to get objects underwater and navigate through an obstacle course. Currently, their apparatus is made of PVC pipe and a plastic mesh which will hold the objects. This experience has been tremendously beneficial to both parties and has empowered, engaged, and enlightened students in robotics and computer science.

References:

1. National Science Foundation. (2014, August). How proficient are U.S. 8th graders in math and science? Retrieved March 28, 2017, from <https://nsf.gov/nsb/sei/edTool/data/middle-03.html>
2. Press Office. (2016, March 16). FACT SHEET: Spurring African-American STEM Degree Completion. Retrieved March 28, 2017, from <https://www.ed.gov/news/press-releases/fact-sheet-spurring-african-american-stem-degree-completion>
3. Ransom, C. (2015, August 18). How Do We Inspire More People To Go Into STEM Fields? Retrieved March 28, 2017, from <http://www.popsci.com/how-do-we-inspire-more-people-go-stem-fields>

4. Bidwell, A. (2015, February 24). STEM Workforce No More Diverse Than 14 Years Ago. Retrieved March 28, 2017, from <https://www.usnews.com/news/stem-solutions/articles/2015/02/24/stem-workforce-no-more-diverse-than-14-years-ago>
5. Ouimet, M. (2015, August 25). 5 Numbers That Explain Why STEM Diversity Matters to All of Us. Retrieved March 28, 2017, from <https://www.wired.com/brandlab/2015/05/5-numbers-explain-stem-diversity-matters-us/>
6. The STEM Workforce: An Occupational Overview. (2016). Retrieved March 28, 2017, from http://dpeaflcio.org/programs-publications/issue-fact-sheets/the-stem-workforce-an-occupational-overview/#_edn28

Pictures:



Umi (grey shirt) and Mr. Butts (top right) are mounting the Arduino on the drone.



Umi (structural engineer) and Victoria (pilot) score 20 points on obstacle course!



After they score, they fly back to the starting point to make another attempt.