Measuring the Effectiveness of Robotics Activities in Underserved K-12 Communities outside the Classroom

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Discussion

• Every day, at least eight million children and youth are left alone and unsupervised once the school bell rings. [1]

• After-school hours are a critical time for youth. That time can represent either an opportunity to learn and grow, through quality after-school programs, or a time of risk to youth’s health and safety. [2]

• Students from underserved communities need exposure to real world situations and should be given such opportunities early in their education, to stay competitive in the world arena of science, technology, engineering and math (STEM).

• Underserved students need more informal education opportunities based on science and technology that challenge young adults in S.T.E.M fields and connect them with the scientific and technology community.
Who’s to blame?

• Lack of STEM programs/resources in underserved communities
• Failing test scores in the areas of Math and Science
• High drop out rates
• Old fashioned teaching methods
• Lack of minorities in science and technology career fields
• Low budgets in Title One school districts
• Heavy teacher emphasis on standardized testing
• Inadequate teacher training and limited content knowledge
Process to engage underserved communities in STEM activities

3 Key Focus Areas:

• Retention

• Pathways to College

• Decrease in exposure to activities that lead to deviant behavior

Our approach meets the needs of underserved communities using a process that connects young people to passionate educators and professional engineers and scientists.
Retention

- **Follow up activities**
  - SFAD (Shadow for a Day), PC2Main, MSIP (Mars Student Imaging Project)

- **Scholarships and Grants to attend future camps**
  - Financial Support

- **Consistent communication between instructors and students**

- **Parent involvement and consultation**

- **Teacher training workshops**

*Policies and practices that affect students generally can benefit minority students as well as others. These practices include a focus on student retention and graduation, rather than just on enrollment; well-aligned and proactive student support services; experimentation with ways to improve student success; and use of data on students to improve programs and services.[3]*
Pathways to College

Summer activities and after school programs that included partnering Universities and Colleges were key in creating real world learning scenarios for the students interested in pursuing STEM related degrees.

- **Shadow for a Day (SFAD)**- Implemented for advanced High school students that participated in our Robotic camps and were provided an opportunity to assist undergraduates from Georgia Tech’s
- **Lunar Robotics and Colonization Camp**- Two week residential camp on campus of GA. Tech/ 48 Middle school students- Robotics and Lunar Colonization
- **Project Identity** – In conjunction with Morehouse College 50 male students participate in a 3 week residential camp that includes Robotics, Forensic Science, and Game design.
- **University and College Field Trips**- Tuskegee University, Morehouse College, Georgia Institute of Technology, Spelman College

*The key to a college’s effectiveness is not whether it adopts particular policies or practices, but how well it aligns and manages all of its programs and services to support student success.* [3]
Decrease in exposure to activities that lead to deviant behavior

Out of school time is when children are considered more susceptible to be lured into devious activities.

- Our summer and after school programs are designed to offer activities that are stimulating and fun, yet isolate student participants from the possibility of being involved in an act of crime.

- Moving into the 21st Century, we must as a community of educators, make accessible activities that are not just centered on recreational sports, but academically benefiting as well.

In America today, between 7 and 15 million young people are alone and unsupervised in the hours after school, before parents return home from work. This situation places children and teens at grave risk for juvenile crime, substance abuse, teen pregnancy, and other problems. [4]
Experimental Design

• Robotics
• Astrobiology
• Aerospace/ Flight Simulations

The afterschool program is centered on “college preparedness” and seeks to increase the local school district ratings in math and science for students in middle school.
The robotic and programming activities were designed to help students learn to apply engineering processes to real life scenarios. Design concepts included:

• Surgical Robot: Mock Image Guided therapy procedure
• Military Robot: Mock bomb disposal
• Lunar Robot: Lunar exploration
Astrobiology

By combining the efforts of the Solar System Ambassador initiative, a 10 week workshop series was conducted that incorporated the Mars Student Imaging Project (MSIP)

- Hands-on activities allowed students to learn how robotics is currently being used to uncover the mystery of life on other planets, namely Mars.

- Students studied microscopic life forms that exist in extreme conditions and their possible existence on other planets, types of minerals that could be found in their research areas, as well as how robotics are used to search for life and explore extreme environments on other planets.

- Students tuned in to live webinars and accessed authentic Mars photos that helped them determine their research site.
Aerospace and Flight Simulations

In partnership with the EAA Young Eagles program, our Aerospace module provided 15 middle school students with the opportunity to learn hands on skills in aerospace technology and the challenge of human aviation and spaceflight through the usage of a Space Shuttle Launch Control Center Simulator, a DreamFlyer flight simulator, and one-on-one student/pilot flights.
Results

- Students displayed an increase in self-esteem
- Students displayed a better attitude toward subjects in math and science
- Students stressed a desire to attend universities that were initially viewed as unrealistic in attending.
- Students that were initially viewed by school faculty as being “troublesome” had less desire to affiliate with the same crowd that demonstrated negative and non-productive attitudes.
- Research found that schools from better economical communities were equipped with more funding to put toward S.T.E.M initiatives and also put a greater emphasis on extracurricular S.T.E.M activities.

- Developed student awareness to quantitative approaches to decision making scenarios in engineering.
- Helped the students understand different kinds of analytical procedures for determining problems as well as problem solutions.
- Helped students to look upon team decision making processes in terms of analytical models with state variables, decision variables and exogenous variables.
- Encouraged the students to be able to use science and technology to arrive at solutions of analytical models.
- Impressed upon the students the importance of Science, Technology, Math and Engineering in different functional areas. [5]
Discussion and Future Work

**AutoSTEM**- STEM based learning camps to engage students with Autism Spectrum Disorders using computing and robotics.

**AroPaBility**- Afterschool and summer camp to broaden participation in computing for students with visual or physical impairments.

**NASA Summer of Innovation**- Lunar Robotics and Colonization Summer Science Camp for grades 8-12, hosted at the Georgia Institute of Technology.

**iSCIENCE**- Residential summer camp for middle school students using hands-on robotic activities comprised of real world Navy based scenarios.

**FlightDay**- Saturday and Summer aviation program that exposes students to the fundamentals of Aerospace and flight as they experience flight simulations and take real one-on-one flights.

**Botball**- National competition used to identify means for increasing the interest of robotics and create a model for teachers to implement STEM learning tools for students outside the classroom environment.
References


