

**Reach for the Stars
(Undergraduate Research Partnered with NASA)**

Singli Garcia-Otero, Ph.D.
Department of Engineering
Virginia State University
Petersburg, VA 23806
804.524.8989 X 1126
Fax: 804.524.6732
sgarcia-otero@vsu.edu

E. Sheybani
Department of Engineering
Virginia State University
Petersburg, VA 23806

Eduardo Garcia-Otero
Department of Engineering
Virginia State University
Petersburg, VA 23806

Reach for the Stars (Undergraduate Research Partnered with NASA)

Singli Garcia-Otero, Ehsan Sheybani, and Eduardo Garcia-Otero

Abstract

The demand for diversified qualified science, technology, engineering, and mathematics (STEM) graduates has increased dramatically in recent years, especially with the retirement of baby boomers ^[1]. Therefore, the nation is facing a serious challenge in educating sufficient numbers of women and underrepresented minorities in the STEM fields to meet the demands of the scientific community. Recruitment and retention are important ways to increase graduation of women and underrepresented minorities. This paper concentrates on retention.

There have been many studies on low retention rates among women and underrepresented minorities in STEM disciplines and different conclusions have been drawn ^{[2][3][4]}. At Virginia State University, the most important factor for retaining students is the students' interest and motivation. The students need to be interested in STEM, and need to be motivated to perform all of the work necessary to complete a STEM degree.

In order to excite and increase the students' interest and motivation, VSU (Virginia State University) and Louisburg College (LC) partnered with NASA to create a summer internship at Goddard Space Flight Center (GSFC), where eight undergraduates worked with NASA scientists on advanced electrical aeronautic projects. This paper documents the impact that this exciting partnership is having on the students.

Background

Virginia State University (VSU)

VSU is a Land Grant institution founded in 1882, located in Petersburg, VA, and is one of 104 Historically Black College and Universities (HBCU) in the United States. Approximately 95% of its more than 5,000 students are African American.

Louisburg College (LC)

Louisburg College is a private, co-educational, two-year residential college (the only two-year residential college in North Carolina, and one of only a handful in the United States). Founded in 1787, it is associated with the United Methodist Church, and offers three Associate degrees to its graduates: Associate in Arts, Associate in Science, and Associate in Science in Business. The school has an enrollment of approximately 700 students, including 70% African.

Due to very limited advanced research opportunities for minorities in HBCUs, there is a scarcity of underrepresented minority engineers and scientists pursuing successful research careers in STEM. A serious national shortage of well-trained underrepresented minority engineers and scientists exists. Well-trained underrepresented minority engineers and scientists can conduct independent engineering research, can focus research efforts on

the disproportionate lack of technical achievement in minority populations, and have cultural perspectives that are essential to the successful conduct of many forms of research involving minority populations.

Partnership between VSU, LC & NASA

In 2010, Virginia State University and Louisburg College were funded by NASA-CIPAR (Curriculum Improvement Partnership Award for the Integration of Research) for a project named "Establishing an Undergraduate Interdisciplinary Curriculum Incorporating NASA Related Research." One of the objectives of the project is to recruit and retain young women and underrepresented minorities in STEM disciplines (especially in NASA-related geospatial science and technology) through the education and research components of an interdisciplinary curriculum, and specifically to motivate and encourage Louisburg College students to pursue and complete a four-year degree in STEM degrees at VSU or other undergraduate colleges/universities. The ultimate goal is to increase the U.S. base of women and underrepresented minorities in NASA-related STEM professional level careers.

One of the components of the project is to involve students in NASA-related research through summer internships at NASA research centers such as GSFC (Goddard Space Flight Center).

In Spring of 2011, we invited a NASA scientist/engineer/mentor to give a talk to the students at VSU about NASA-GSFC. More than thirty VSU engineering students were interested in the internship. The five VSU students selected to participate in the internship.

Internship in GSFC (Goddard Space Flight Center)

During summer 2011, 5 VSU and 3 LC students spent 8 weeks at GSFC and conducted 5 different research projects: Radar Signal Processing, FPGA Programming, Test Antenna in The Antenna Anechoic Chamber, Characterize a Compact Superconducting Channelizing Band-Pass Filter, and monitor the health of the riparian buffer zone along the Tar River.

The minority students gained valuable career experiences through the summer research internships which included high tech undergraduate research opportunities in NASA-related engineering and science fields. Following are some quotes from the students:

- Now that I know how to research and understand the concepts I need to know, nothing will stop me from learning.
- The days are coming closer and closer to an end here at NASA. I have had such a good experience here and have learned much...
- ... I finally see how it feels to be a scientist; working long hours running tests only to have all of them fail. I realize now that I did not fail; I simply found a way how not to build a control box....
- This time here at Goddard has been very exciting and informative. I got a chance to see how engineers work in such an important facility..... It is going to be a bittersweet feeling leaving here after this upcoming week.
- The most important thing I have learned is that everything done at NASA cannot be

learned by reading a textbook. To open up your mind and explore new possibilities, you have to think outside the box. The things I learned at NASA, everyday people don't even talk about them because they can't even imagine them.

- I was interested in the things that NASA does. I wanted to gain experience in my field and this was a perfect opportunity to work with some of the best Engineers around. I learned how certain things are proposed and done. I witnessed how Engineers operate in the workforce.
- The most important thing I learned at NASA is to read. Plenty of times I was asked questions with the answer directly in my face, but I had not yet read what was in my face.

Impact of Project

This is only the first year of our project, but the impact is tremendous. Having gained high level experience and expectations at NASA Labs, the NASA summer internship students also gained a very positive attitude towards learning more at school. The new improved attitude towards learning has created a very positive atmosphere in the classroom for their classmates, as well as for teachers. These students now understand the need for grasping the hard concepts in math, science, engineering and technology. By talking about their experiences at NASA, these students are also motivating the rest of the class and encouraging them to try such internship opportunities. These students also continue their research in the Interdisciplinary Data Processing Lab at VSU. Some of these students plan to extend their research as senior design projects.

The Future

We will send more students to the NASA center the next two summers, and will involve more students in the research. The students will bring back the NASA culture to the classroom, and we believe the retention rate will increase

Acknowledgment

The authors would like to acknowledge NASA CIPAIR grant (award# **NNX10AU70G**) for the for the financial support.

References

1. U.S. Department of Labor, ftp://ftp.bls.gov/pub/special.requests/ep/ind-occ.matrix/occ_pdf/occ_17-2000.pdf
2. Felder R., Felder G., & Dietz E., (2002) "The Effects of Personality Type on Engineering Student Performance and Attitudes," *Journal of Engineering Education*, 91(1), 3-17.
3. Flemming L., K.Engerman, & D. Williams, (2006) "Why Students Leave Engineering: The Unexpected Bond," American Society for Engineering Education.
4. Seymour, E., & Hewitt, N. (1997) "Talking About Leaving: Why Undergraduates Leave the Sciences," Boulder, Colorado: Westview Press.
5. Barger, M., Goff, G., & Rogers, H. (2003) "Bridging a Gap: A.S. to B.S. Articulation in Florida," American Society for Engineering Education.

6. Newman, R., Munukutla, L., & Robertson, J. (2002) "Building Bridges with Community Colleges, Partnering for Educational Success," American Society for Engineering Education.