

# **Achieving and Sustaining Excellence in Outreach and Engineering Education Programs: K-16 and Beyond**

**Berrin Tansel**

Florida International University, College of Engineering and Computing  
Miami, Florida, USA, [Tanselb@fiu.edu](mailto:Tanselb@fiu.edu)

**Vish Prasad**

Florida International University, College of Engineering and Computing  
Miami, Florida, USA, [Prasadv@fiu.edu](mailto:Prasadv@fiu.edu)

**Gustavo Roig**

Florida International University, College of Engineering and Computing  
Miami, Florida, USA, [Roigg@fiu.edu](mailto:Roigg@fiu.edu)

## **ABSTRACT**

The Center for Diversity in Engineering and Computing within the College of Engineering conducts programs both during the school year and summer months to prepare young students to deal with the rigors of higher-level education, and Engineering in particular. These programs are aimed to recruit, retain, and graduate ethnically diverse student body that will increase the representation of traditionally underrepresented ethnic and gender groups in the field of engineering and will enrich the College of Engineering and the university as a whole. This paper provides a summary of the completed and on-going programs in outreach conducted by the Center and the recent accomplishments of the College in increasing diversity.

**Keywords:** Outreach, diversity, STEM education, recruitment and retention.

## **1. INTRODUCTION**

The Center for Diversity in Engineering and Computing within the College of Engineering conducts programs both during the school year and summer months to prepare young students to deal with the rigors of higher-level education, and Engineering in particular. These programs are aimed to recruit, retain, and graduate ethnically diverse student body that will increase the representation of traditionally underrepresented ethnic and gender groups in the field of engineering and will enrich the College of Engineering and the university as a whole.

The Center's goals are:

1. **Student diversity and quality:** Active recruitment and retention of students from underrepresented groups in the College of Engineering.
2. **Quality of education:** Enhancement of the capacity for STEM education by providing access to comprehensive educational resources and research environment to program participants.
3. **Institution of recruitment and retention mechanisms:** Development of programs and procedures to maintain a steady fraction of students from traditionally underrepresented groups are enrolled in the engineering program.

4. **Service to the community:** Programs for elementary, middle, and high school level students and parents to prepare the students for the higher-level education.

The programs are designed to achieve:

**Recruitment and retention of students from underrepresented groups in PhD programs in Engineering:** Formalized sustainable mechanisms for active recruitment and retention of students from underrepresented groups to science and engineering fields.

**Access to quality education:** Support mechanisms to provide opportunities to students from underrepresented groups with excellent academic records and financial need to educational resources.

**Creating a culture of achievement:** Programs for mentoring and specialized academic advising to ensure that the students complete their degrees in accordance with their planned program of studies.

**Formalized recruitment and retention mechanisms:** College wide policies and procedures to maintain a steady fraction of students from traditionally underrepresented groups with financial need to be able to complete their program.

## **2. RECENT ACCOMPLISHMENTS OF THE COLLEGE OF ENGINEERING AND COMPUTING IN DIVERSITY PROGRAMS**

Recently, FIU's College of Engineering and Computing was been selected by the Accreditation Board of Engineering and Technology (ABET) as one of the three 2006 ABET President's Diversity Award winner for extra-ordinary success in achieving diversity and inclusiveness in the technological segments of our society.

According to American Society of Engineering Education (ASEE) in its 2005 report, FIU has emerged as the national leader in producing engineers from underrepresented groups (ASEE, 2005). FIU ranks (ASEE, 2005):

- #1 in Doctoral Degrees Awarded to Hispanics in Engineering and Computer Science, including Puerto Rico (tied with Berkeley , Illinois - Urbana and Georgia Tech.);
- #1 in Master Degrees Awarded to Hispanics in Engineering and Computer Science, including Puerto Rico;
- #1 in Bachelor Degrees Awarded to Hispanics in Engineering and Computer Science, among fifty states (excluding Puerto Rico ); and
- #19 in Engineering Bachelor Degrees Awarded to African-Americans.

## **3. OUTREACH PROGRAMS**

With a sprawling urban system of more than 380,000 students and over 333 schools, the student population in the Miami-Dade County Public Schools (M-DCPS) is composed of a large proportion of minorities which provide majority of FIU's student body. South Florida's distinction as a multicultural, multi-lingual region has long been a diverse source of talent for Florida International University (FIU), particularly in the College of Engineering and Computing.

In collaborations with the public schools and professional organizations, educational support and services offered through the Center's activities include:

- Emphasis on science, technology, engineering, and mathematics (STEM) skills for a diverse student population,
- Outreach and parental educational materials,
- Financial aid and student internships,
- Mentoring,
- Curriculum development and support,
- Teacher training,
- Vertical teaming relationships among educators at all levels,
- Integration of technology into classrooms,
- Dissemination of effective science and engineering education practices to schools.

Center has been conducting programs targeting Elementary, Middle, and High School level students. These programs are offered throughout the school year and during the summer. GEAR UP! (Gaining Early Awareness and Readiness for Undergraduate Programs), ENLACE MIAMI (Engaging Latino Communities for Education), FLAME (Florida Action for Minorities in Engineering), Proyecto Access/Miami PREP (Prefreshman Engineering Program), and Tele-MAESTRO (Mathematics, Arts, Engineering, Science, and Technology Reach Out) are all efforts to encourage higher education in our community and provide opportunities to students in Miami Dade County Public Schools, from elementary to high school level. The Center also provides job and scholarship opportunities for FIU students. FGLSAMP (Florida-Georgia Louis Stokes' Alliance for Minority Participation) and SHPE Honores (Society for Hispanic Professional Engineers) provide many students with financial assistance. FGLSAMP and SHPE Honores scholarship recipients are assisted in acquiring internships. Many are offered Summer Research Internships at NASA Centers around the country. Each of these programs focuses on specific components of the education pipeline.



**Figure 1. Logo's of programs offered at Center for Diversity in Engineering and Computing at Florida International University.**

Examples of the completed and on-going outreach efforts include:

- ENLACE Miami! (Engaging Latino Communities for Education) is a collaborative, community-wide partnership for education led by the Center and sponsored by the W.K. Kellogg Foundation Initiative in Hispanic Higher Education. Its mission is to increase the representation of Hispanics in the higher education pipeline.
- FLAME (Florida Action for Minorities in Engineering) program aims to introduce the profession of engineering to high school students and to identify, select, enroll and retain minority students in the engineering field.
- GEAR UP! (Gaining Early Awareness and Readiness for Undergraduate Programs) is sponsored by the U.S. Department of Education and focuses on enhancing the academic, personal, and emotional development of students and their families. This program aims to develop and cultivate the self-expectation of success in each student.
- JETS (Junior Engineering Technical Society) provides access to resources for high school students to explore the exciting and challenging world of engineering through educational information packages, self assessments, real-world problem solving experiences, team oriented learning and competitions.
- MASTT (Mathematics Sciences Teacher Training) program is sponsored by NASA/Kennedy Space Center and it is designed to provide training for the pre-service and in-service teachers in elementary and middle schools for science and mathematics education.
- FG-LSAMP (Florida-Georgia Louis Stokes' Alliance for Minority Participation) focuses on enhancing the technical skills of undergraduate students in engineering, math, chemistry, biology, physics, and computer science. Participants receive scholarships based on their academic achievements and progress.
- Proyecto ACCESS/Miami PREP (Prefreshman Engineering Program), also sponsored by NASA/Kennedy Space Center, is designed to identify socially and economically disadvantaged middle school students who are interested in science, technology, engineering and mathematics careers and provide the necessary enrichment opportunities.
- Tele-MAESTRO (Mathematics, Arts, Engineering, Science, and Technology Reach Out), sponsored by NASA/Kennedy Space Center, is an innovative educational program developed in the Spanish language, by and for Hispanic minorities. Its purpose is to bring math, science and technology to Hispanic youth through televised, Spanish language media to bridge the technology gap for the nation's Hispanic minority.

- Mathematics Matters Everyday (M2E) project seeks to develop a portal for research-based online modules designed to provide innovative best practices for teaching mathematics. The M2E project is designed to develop STEM modules that are designed for delivery of quality teaching and learning resources appropriate for educators at the K-12 levels.
- Bernard Harris – Exxon Summer Enrichment Camp is a 2-week residential program for 6<sup>th</sup> graders with hands-on technology training, in depth science skills development, and math activities.

### 3. CONCLUSIONS

The Center for Diversity in Engineering and Computing within the College of Engineering has been successful in conducting outreach programs which has been successful in the following areas:

- **Changing attitude for STEM:** Improve interest and comfort level of K-16 teachers, students, and families with STEM subjects.
- **Aligning rigorous academic standards in K-12 in STEM education:** Raise expectations that all students need strong skills in STEM fields.
- **Teacher training and professional development in STEM disciplines:** Promote and disseminate programs for enhancing teacher qualifications, knowledge, and skills in STEM education.

### 4. AUTHORIZATION AND DISCLAIMER

The following words will appear in the Authorization and Disclaimer section at the end of the document: “Authors authorize LACCEI to publish the papers in the conference proceedings. Neither LACCEI nor the editors are responsible either for the content or for the implications of what is expressed in the paper.”

### REFERENCES

Roig, G., Tansel, B., “Pre-K to 16: Aiming for Excellence in Community Outreach and Engineering Education”  
*Presented at the Latin American Caribbean Consortium of Engineering Institutions First Conference, June 2-4, 2004, Miami, Florida.*