

## **Project MASTT: A Model Program to Motivate K-8 Students to Pursue Scientific and Engineering Careers**

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### **Abstract**

Project MASTT (**M**athematics/**A**ppplied **S**ciences **T**eacher **T**raining) is a collaboration of the NASA/JFK Space Center, the Miami-Dade and Daytona Volusia County public schools, the Public School System of Puerto Rico, Turabo University, Bethune-Cookman College, and Florida International University.

The MASTT program is mainly focused on training elementary and middle school educators (K-8) in the subjects of science and mathematics through the learning module presentations in a classroom setting, as well as through educator workshops. The learning modules are educational activities developed by the program using a vast quantity of high quality educational activities from NASA and other scientific depositories freely available on the Worldwide Web. The program broadens its scope to utilize teacher training activities to attract K-8 level minority students to careers such as science, technology, engineering, and mathematics (STEM).

Founded in 1997 with a grant from the NASA/ JFK Space Center, Project VISION, presently called MASTT, served as a model for teacher training and pre-college education programs. Last 2004-2005 academic year, more than 300 in-service teachers with their students at more than sixty elementary and middle schools were provided a suite of opportunities to help educators improve the quality of K-8 science, technology and mathematics education.

### **Keywords**

Pre-college K-8 program, teacher training, STEM careers, a career guidance, diversity

### **1. Introduction**

Project MASTT (**M**athematics/**A**ppplied **S**ciences **T**eachers' **T**raining), is a pre-college education program mainly focused on training elementary and middle school teachers in the subjects of science, mathematics, and technology education. Currently, Project MASTT serves teachers and students primarily from the K through 8<sup>th</sup> grade (or K-8). Project MASTT, a continuation of the four-year program Project VISION (**V**ery **I**ntensive **S**cientific **I**ntercurricular **O**n-Site Education), assists pre-service and in-service teachers in their effort to improve the quality of elementary and middle school

science, technology and mathematics education. Topics, content knowledge, experiments and latest information concerning teaching methodology are created and compiled by consortium: NASA/ JFK Space Center, Miami-Dade County Public School System, Daytona Volusia County Public School System, the Public School System of Puerto Rico, Bethune-Cookman College, Universidad del Turabo and Florida International University.

By using specific MASTT strategies, the program expects raising standards in the basics to go hand-in-hand with a broader curriculum. The program attracts young children to different engineering careers and introduces their descriptions through the means of learning module presentations which are based on the subjects of mathematics and science. Students are inspired to pursue science, technology, engineering, and mathematics (or STEM) careers by relating them to science and mathematics concepts presented in the learning activities developed by program.

Project MASTT strives to increase the numbers of students, especially those from traditionally underrepresented minority groups, who choose a professional career in the areas of STEM. The method developed by Project MASTT to accomplish this goal consists of an indirect approach through the on-site teacher training services where the students are also present. The program broadens its scope to utilize Project MASTT teacher training sessions and other strategies to attract diverse student populations at the elementary and middle school level to careers in STEM fields, as well as teaching, which aligns with NASA Strategic Goal 6.

## **2. The Objectives of the MASTT Program**

Project MASTT objectives are to:

- Make available to elementary and middle school science, mathematics, and technology teachers the learning activities that provide opportunities for “hands-on”, teamwork, and an introduction to different engineering careers and their descriptions.
- Use MASTT on-site training sessions and educator workshops to assist teachers in their effort to improve students’ Florida Comprehensive Assessment Test (or FCAT) performance.
- Fulfill part of NASA’s mission to “give educational aid to those students at a disadvantaged status” as Project MASTT strives to target as many minority schools as possible.
- Use MASTT on-site teacher training sessions to arouse student interest in STEM fields of study as a career choice and a future profession.
- Disseminate information regarding content, programs, and services offered by NASA for educators.

Since 1997, Project VISION has developed the learning modules using the vast quantities of high quality lesson plans, hands-on labs, experiments and other educational activities from NASA. The project also used other scientific and educational depositories freely available on the Worldwide Web. Project VISION learning modules are designed to teach key science, mathematics and technology concepts in the existing science and mathematics school curricula through collaborative and activity-based learning (i.e. manipulatives, hands-on labs, demonstrations, etc.). They integrate science and mathematics content and pedagogy (methods, techniques, and strategies) as well as the successful instructional practices from the field-testing experience. In addition, Project VISION and Project MASTT developed and implemented several learning modules in science, technology, engineering, and mathematics (STEM) that provide an introduction to different scientific and technological careers and encouragement for students to pursue careers in these fields of study.

According to statistics, about a third of the school-age population consists of U.S. underrepresented minority students. However, over three-fourths (77%) of the working population in science, technology, engineering, and mathematics (or STEM) occupations is predominately white, with a fair representation of Asians (about 12 %), but only about 11% of African American, Latino, and American Indian participants. While women comprise about half of the school-age population, they represent only about a fourth of the STEM workforce. Today, when the U.S. economy requires more STEM workers, the largest pool of potential workers continues to be isolated from STEM careers. The current and imminent national need thus demands for strategies designed to create an engineering workforce that looks like America.

As we have mentioned above, among objectives of the MASTT program are those designed to increase the number of historically underrepresented ethnic minority students (African American, Latino) who are motivated to pursue careers in STEM related fields. One of the biggest advantages to the program is that students learn basic mathematics and science concepts while their teachers are being trained. This is because the training is provided to the in-service teachers in the classroom setting where their students are also present. Key aspects of the MASTT in-service teacher training program include its year-long continuity, as well as its integration into the public school system with the focus on MASTT teacher training services as the current and imminent need to upgrade and enhance the instructional practices primarily in the middle and elementary grades. By offering its training services to teachers in science, mathematics and technology areas, the program strives to simultaneously arouse student interest in scientific and technological fields of study as a career choice and future profession.

### **3. The MASTT as a Pre-College Education Program**

As statistics show, a disturbingly narrow range of U.S. citizens pursue STEM careers. The current and projected need for more STEM workers, coupled with the lagging participation of students from ethnically growing segments of the population, argue for policies and programs that increase the flow of underrepresented ethnic minorities into engineering. To prepare a diverse and culturally competent engineering workforce, the educational environment for prospective engineering students must be systematically improved across the K-12 educational continuum. Particular attention must be paid to transition points along that continuum (i.e., elementary to middle school, middle to high school, high school to college). Students in K-12 education ought to have exposure to career guidance. It is our understanding that in order to resolve this situation, it is necessary to begin introducing the career literacy and some elements of engineering content as early as elementary and middle school level (K-8 education). Project MASTT has moved forward to improve the teaching and learning of STEM activities across the K-8 education. Systemic improvement requires selecting and implementing best practices existing in science and engineering education of K-8 students, increasing their career literacy, and building the motivation and interest towards scientific and engineering careers.

The following strategies have been used by the MASTT program to increase the number of minority pre-college (K-8) students progressing to high school STEM programs and attract them to careers in science, technology, engineering and mathematics:

- promoting awareness of the scientific and engineering profession
- providing academic enrichment through the in-school learning module presentations that follow science, mathematics and technology school curricula
- offering science and mathematics training services to elementary and middle school instructors

- being supported by the educational system of the teacher and student participants (i.e. schools and school districts)

Founded in 1997 with a grant from the NASA/ JFK Space Center, Project VISION, presently called MASTT served as a model for teacher training and pre-college education programs. Last 2004-2005 academic year more than 300 in-service teachers, along with their students at more than sixty elementary and middle schools were provided a suite of opportunities to help educators improve the quality of K-8 science, technology and mathematics education.

In addition, MASTT incorporates annually a team of approximately 20 pre-service teachers that meet on a daily basis to support program goals. These are the undergraduate students aspiring to be engineers and teachers who, formally working in our program, form the diverse Project MASTT team of pre-service teachers. Pre-service teachers are specially trained at each site (at FIU, at BBC, at University of Turabo) on a daily basis in order to be able to present learning modules for in-service teachers through the training sessions in a classroom setting and educator workshops. At the same time, our team of pre-service teachers served as the role models inviting youth to prepare for a demanding, productive, and lucrative career of engineering. The MASTT program is trying to equip K-8 students with the tools for knowing where to go for the STEM careers, how to get there, and what they need to do once they are there. Images of Project MASTT pre-service teachers who are future engineers along with an explanation where they will work, and what they will do definitely affect and influence student choices.

The MASTT programmatic offerings consist of year-round in-school learning modules presentations, collaboration with several projects in their summer programs, and an active involvement in the annual Engineering Gala that pertains to a campaign named National Engineers Week. In-school learning module presentations serve as a possibility to introduce K-8 students to different engineering careers, while their presenters, prospective engineers and teachers, serve as the role models that help to promote the image of engineers and engineering as a career choice. Summer programs are designed to effect improvement in science and engineering education of pre-college (5<sup>th</sup> through 8<sup>th</sup> grade) minority students. A campaign such as National Engineers Week, in particular, informs, spurs interest, and connects curious students with role models, organizations, and media that can help to cultivate aspirations. More than 25,000 students have been exposed to their STEM career guidance at the VISION/MASTT program since its inception.

Starting in September 2004, MASTT received its seventh year grant from NASA/JFK Space. It is apparent that there are still many opportunities ahead – foremost among them is to attract diverse pre-college populations who will be enrolled with us into scientific and engineering careers. The next step in the implementation of the program will be to offer the teaching and learning of STEM activities through the teacher training services to a larger population of elementary and middle school teachers.

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