

Pre-Service Teacher Program (PSTP)

National Institute of Aerospace and the University of Maryland Eastern Shore

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PROGRAM DESCRIPTION

Objectives of PSTP (Conference, Institute, and Teacher Training)

The PSTP in 2007-2008 has been arranged around the following major activities and efforts that go into making the program a success:

- Annual national 3-day conference in the Washington, D.C. area;
- Two-week Summer Institute for the Pre-Service Teachers at NASA facilities (Langley Research Center);
- Two-day Pre-Institute Training Session for institute faculty to be held at Langley Research Center.

The three-day conference was again planned and held at an appropriate location in the Washington, D.C. area (Alexandria, VA) in mid-February for about 350-400 participants from member universities throughout the nation. Particular emphasis was on involving minority students from Historically Black Colleges and Universities (HBCUs), Tribal Colleges and Universities (TCUs), Hispanic Serving Institutions (HSIs), and other majority universities that have shown significant achievement in diversifying their student bodies, as well as those that have popular and exciting programs involving minority students. The current list of more than 130 member institutions was the primary source of participants for the Pre-Service Teacher Conference. It is anticipated that the program will grow in the future to include other minority universities and appropriate majority institutions.

A two-week Pre-Service Teacher Summer Institute for the pre-service teachers will again be held at Langley Research Center for approximately 20 pre-service teachers. The summer institute held at Langley will be integrated with and supported by the PSTP budget. The PIs and the NIA PSTP Director will have oversight responsibilities for the Langley Institute so as to ensure that the objectives are achieved for all participants. Instructional modules developed at Langley for the institute will be provided to the institute faculty for other institutes so that they may adopt and adapt the contents while implementing the same during the 2-week summer institutes held at their respective locations.

NIA and Langley have been working, via emails, teleconferences and the DLN, with the other 9 Centers to ensure standardization of all of the Institutes using the STEM curriculum developed for this purpose.

PROGRAM RELEVANCE TO NASA

As a result of these activities, NASA will expand its service capability and network for enhancing the education of teachers and children in the nation's elementary and middle schools. Further, institutions serving a large population of minority students will improve their programs for preparing teachers to teach science, technology, engineering, and mathematics (STEM) to young children.

PROGRAM BENEFITS TO SOCIETY

This Program has been instrumental in preparing teachers to encourage, assist, affirm and educate the next generation of explorers.

NASA's ability to achieve its "Strategic Enterprises" and missions and America's ability to compete globally in fields involving science, technology, engineering, and mathematics are dependent on our ability to **produce a productive workforce** well-schooled in these fields. The critical shortage of mathematics, science, and technology teachers well-qualified to provide high-quality instruction at the elementary and middle school levels hampers our ability to do this. Project 2061, launched by the American Association for Advancement of Science (AAAS), stated that science literacy and the number of students interested in careers in science and mathematics have been in a steady decline in the U. S. for a number of years. A national awareness to improve teaching and learning in science and mathematics is occurring in response to this decline. Teaching vacancies, especially in rural districts and those serving significant numbers of disadvantaged students and other underrepresented groups, are being filled by teachers and others who are not necessarily well-qualified through a pre-service curriculum that features a strong foundation in STEM content knowledge that is linked to effective pedagogical strategies. One of the major obstacles facing reform in education is the lack of adequate preparation among teachers (Koency, 2000). Recent graduates enter the teaching profession already in desperate need of intensive professional development (Peck and Connell, 1991). It is evident that through the integration of STEM in the curriculum, students are able to better comprehend the key concepts and principles of science and mathematics. Consequently students are able to apply the scientific knowledge to real-life situations (Science for All Americans, 1992). The need for emphasis in STEM education in K-12 and beyond is paramount to the development of the future workforce of the nation and its ability to compete successfully in the increasingly technology-driven global market of the future. The future workforce in STEM areas will have to successfully attract individuals from the underrepresented minority groups to meet the vast human resource needs (COSPUP, 2006; Orfield *et al.* 2004). NASA, NSF, the Department of Education, and other federal agencies are playing an active role in these efforts. PSTP is one such effort developed and implemented by NASA for pre-service STEM education majors in partnership with colleges and universities of higher learning. The PSTP project has been ongoing since 1995 with the overarching goal of providing enrichment activities to pre-service STEM teachers, exposing them to best practices in K-8 STEM education, and introducing them to advanced technologies utilized at NASA, government laboratories, and modern industries that have relevance to K-12 STEM education. The University of Maryland Eastern Shore, in partnership with NASA and NIA, has been addressing this priority through the development of the Pre-Service Teacher Program, involving pre-service teachers, faculty, and staff to improve STEM instruction in elementary and middle schools in the United States with the aims of increasing the quantity, quality, and diversity of STEM teachers at the elementary and middle school levels nationally.

PROGRAM GOALS

Conference

- To refine a model teacher education and enhancement strategy in STEM that may be duplicated throughout the nation
- To enhance pre-service elementary and middle school teachers' knowledge, skills, and strategies for STEM teaching
- To promote enthusiasm and self-confidence for teaching STEM among pre-service teachers of young children

- To provide the participating pre-service teachers and advisors with relevant curricula and resource materials for STEM teaching at the elementary and middle school levels
- To enhance the knowledge, skills, and attitudes of teacher education faculty in the areas of STEM and foster education reform in those fields

Institute

- Develop a more positive attitude toward the teaching of STEM
- Understand the value of team work/collaboration
- Develop a deeper understanding of STEM concepts
- Learn to use hands-on activities to teach STEM concepts
- Learn to use technology to teach effectively
- Design and deliver a lesson that effectively integrates STEM using an inquiry-based teaching model
- Become familiar with and utilize NASA facilities, personnel, materials, and curricula so as to ensure consistency

Teacher Training

- Work to achieve the same objectives at every institute
- Draw ideas from the model institute developed at Langley and adopt and adapt them suitably
- Facilitate the development of a centralized certification/accreditation effort for pre-service teacher institutes in the future
- Expose institute participants to appropriate technology and problem-based learning modules consistent with the model developed at Langley

PROGRAM ACCOMPLISHMENTS

The University of Maryland Eastern Shore, NASA, and NIA have hosted highly successful national conferences from February '06-'08 with over 300 pre-service teachers, faculty advisors, and ambassadors from over 50 HBCUs, HSIs, TCUs, and some majority institutions, from the District of Columbia and 37 states. On average, over 60 professional development STEM and pedagogy workshops were offered. Speakers presented informative and motivational messages, reaffirming the importance and impact of the education profession. A Career Fair, with representatives from about 30 school districts, graduate schools, and professional organizations, was another highlight of the conferences. Given the generally positive responses to the specific conference evaluation criteria, including the successful administration of the event, it can be said that the conferences were successful and the basic conference objectives were successfully met.

In the summers of '06 and '07, summer institutes took place in 5-6 locations associated with NASA sites—Johnson, Kennedy, Marshall, Ames, Stennis, and Langley. UMES was directly involved with the Langley institute, which was very successful, hosting 24 pre-service teachers for 2 weeks from colleges and universities from various states. The students had instruction in science, math, technology, robotics, lesson design, diversity, and 21st century teaching. The students had the opportunity to explore the NASA Langley Research Center and visit the Virginia Air and Space Center, the Educator Resource Center, and Historic Jamestowne to study exploration then and now. Their projects for the institutes were designing and presenting interdisciplinary lessons, based on aeronautical/exploration themes and using inquiry and problem-based learning, to elementary school children. Institute students were able to receive 3 credit hours for

participation in an integrated STEM course. A summer institute is currently being planned at Langley for 2008.

STUDENT ACCOMPLISHMENTS

Overall, the accomplishments of the Pre-Service Teacher Program have been consistent with the mission and purpose of NASA and NIA, and in particular, the LaRC Office of Education. The PSTP efforts have remained true to the goal of inspiring and motivating the next and succeeding generations of scientists, mathematicians, engineers, and explorers. As in the past, the emphasis of the program has been on providing prospective grades 4-8 teachers with enrichment activities that included NASA instructional methods and materials, that were all aligned with NASA's goals and objectives and the national standards.

Most of the graduates of the summer institute are either teaching, are in graduate school, or are doing both. Those who are teaching are assisting their principals with creating a paradigm shift: They are teaching an integrated STEM curriculum, with their colleagues, using NASA materials. They have developed self-confidence and an enthusiasm for teaching STEM.

Grant Title: NASA MSFC Pre-Service Teacher Institute
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Program Description:

The NASA Marshall Space Flight Center Pre-Service Teacher Institute (PSTI) is a 2-week residential training project for elementary education majors at minority serving institutions. The PSTI provides intensive training in problem-based learning and the use of NASA curriculum resources.

Program Relevance to NASA:

PSTI provides training for pre-service teachers that will enable them to engage students in science, mathematics, engineering, and technology learning activities using NASA related curriculum resources. The project trains future teachers to use problem-based learning as a method for teaching early childhood and elementary students.

Program Benefits to Society:

The impact of the project lies in the teaching strategies the participants gain as well as the skills they gain in the use of NASA curriculum resources.

Hundred of elementary school children will receive the benefits of the PSTI throughout the teaching careers of the PSTI participants.

Program Goals:

To raise future elementary teachers' awareness of mathematics, science, and technology challenges in tomorrow's classroom.

To train future teachers to use NASA curriculum resources to facilitate improved teaching in mathematics, science, and technology.

To provide pre-service teachers with training in the use of problem-based learning for instruction in mathematics and science.

Program Accomplishments:

The FY 2007 MSFC Pre-Service Teacher Institute included thirteen participants from six minority serving institutions.

The MSFC PSTI provided a wide range of workshops by NASA scientists, NASA education specialists and college and public school faculty.

The MSFC PSTI was featured in a story on the NASA Portal.

Evaluation data shows that the Project was successful in modeling the used of scientific inquiry through problem-based learning, enhancing knowledge, skills, and strategies for teaching mathematics and science, and promoting enthusiasm and self-confidence for teaching science and mathematics.

Student Accomplishments:

All participants developed and taught lessons based on NASA content to fourth grade students at Oakwood Academy.

Participants developed plant growth chambers, built rockets, and engaged in a variety of scientific experiments.

Participants learned to use model lessons developed and taught to them by NASA Explorer School teachers.

Participants engaged in learning activities at the US Space and Rocket Center and the Sci-Quest Hands-On Science Museum.

Participants participated in a Digital Learning Network workshop on weather in which that used NASA data to predict severe weather.