
AC 2011-2111: INNOVATIVE STEM CONFERENCE (ISC): OUTREACHING TO UNDERREPRESENTED MINORITIES IN AN EFFORT TO INCREASE THEIR PARTICIPATION IN STEM RESEARCH

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In 1987, Dr. Carl White joined Morgan State University's School of Engineering in Baltimore, Maryland, as an assistant professor. He is currently the Associate Dean for Research & Development and Graduate/Professional Programs, as well as a full professor in the Department of Electrical Engineering. Dr. White has over ten years of experience in the management of funded research, both technical and educational. Dr. White's most recent award was from NASA's University Research Center program to establish the Center of Excellence in Systems Engineering for Space Exploration Technologies. As the Associate Dean for Morgan State University's School of Engineering, Dr. White's primary tasks are to provide support for the research endeavors conducted by faculty and associate researchers within the School of Engineering, to oversee the quality of the graduate program offerings, and to manage recruitment and retention programs in order to establish and sustain a pipeline of quality engineering graduate students and research professionals.

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The Dean of STEM Programs at Bluford Drew Jemison Academy is Mr. Clifton Martin, who received his Bachelor of Science Degree and Master of Science Degree in Electrical Engineering from Morgan State University and is presently working on his Doctorate Degree in Math Education. Mr. Martin has worked at NASA Goddard Space Flight Center and the Nuclear Regulatory Commission (NRC) as a Power System Engineer. He has taught high school Mathematics in the Baltimore City Public School System as well as Mathematics at several colleges and universities. Just before coming to BDJ, Mr. Martin worked for the Maryland State Department of Education as a Regional Coordinator for Career and Technology Education, where he assisted many local school systems with their implementation and management of pre-engineering and technology programs.

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Innovative STEM Conference (ISC): Outreaching to Underrepresented Minorities in an Effort to Increase their participation in STEM Research

Background

The United States faces a significant problem. There is currently a shortage of STEM (Science, Technology, Engineering, and Mathematics) professionals needed to address U.S demand. As the country continues to increase its technology requirements and needs, the demand for qualified and trained STEM professionals will continue to grow. However, the STEM pipeline that supplies the professionals is insufficient and shrinking. This problem poses a threat to the U.S' position in the world as a superpower. If there is not a sufficient pipeline to meet U.S. demand, then the country will not have the trained personnel required to remain competitive in the global economy or continue its standing as a leader in technological research.

In addition to being inadequate, the pipeline also needs to diversify. According to a report published for Congress, Blacks, Hispanics, and Native Americans as a whole comprise more than 25% of the population; however, they earn 16.2% of the bachelor degrees, 10.7% of the master's degrees, and 5.4% of the doctorate degrees in science and engineering¹. There needs to be an increased effort to recruit from historically underrepresented groups, in order to diversify the current pipeline. The nation's population is a rapidly changing and diverse one, and without a likewise diverse STEM pipeline, the country will not be able to effectively address the needs of all its citizens with respect to their varied cultural, linguistic, economic, and educational backgrounds.

The effective recruitment of these underrepresented groups will address the U.S's critical problem of a worker shortage. Additionally, if these groups are attracted to science, technology, and engineering, then it will add diversity to the pipeline. In order to successfully recruit these students, there needs to be new and innovative methods of outreaching to middle school, high school, and undergraduate students that may not have otherwise been interested in STEM.

There have been several successful exposure and recruitment efforts over the past few years, including conferences, summer programs, in-school programs, and other initiatives. In Fall 2010, the inaugural Science and Engineering Festival was held in Washington, D.C with strong support from the White House and Congress. There was over 500,000 individuals from all ages and backgrounds that attended the festival where they were exposed to hundreds of companies and over a thousand different hands-on exhibits. Another STEM initiative is Project Lead The Way (PLTW), which is an extremely effective program, with a strong history of success. PLTW offers a rigorous, engaging, hands-on curriculum to provide middle school and high school students with a relevant, quality STEM education. Other initiatives, specifically at Morgan State University, include the Summer Institute of Robotics (SIR) and the Pre-Freshmen Accelerated Curriculum in Engineering (PACE) summer programs. These efforts are all concentrated on responding to the STEM shortage challenge that the U.S is facing. Likewise, in 2008, the Innovative STEM Conference (ISC) was created to address this challenge.

Conference

In 2007, the Academy of Applied Science awarded Morgan State University's School of Engineering (MSU) the grant to administer the Maryland Regional-Junior Science and Humanities Symposium (JSHS). The JSHS is an Army, Air Force, and Navy joint sponsored program which promotes research and experimentation in the STEM areas among high school students (Grades 9th-12th) and recognizes them for their achievement in a public setting. Its belief is that by connecting students, teachers, and research professionals it will increase the pool of qualified individuals who can conduct research and development vital for the United States.

There are 48 regional university-held symposiums throughout the nation, where the students compete and the regional winners advance to the annual National JSHS competition. Students are required to submit an abstract, and if accepted then they are required to complete a research paper and present their work at their regional symposium. The JSHS has been in existence for over 40 years and has shown great success in involving high school students in original research, and adding them to the STEM pipeline. The JSHS reach over 10,000 high school students across the continental United States, as well as Puerto Rico and the Department of Defense Schools of Europe and the Pacific Rim. Morgan State was awarded the grant because it demonstrated the ability to increase the numbers of minorities that participated in the Maryland-regional JSHS.

In 2008, MSU partnered with the Innovative STEM Foundation (ISF) to create the Innovative STEM Conference (ISC). The ISC was actualized in order to reach a broader audience of students. It is primarily aimed toward increasing the number of underrepresented groups conducting research in the U.S. The mission of the ISC is to:

- Bridge the technology gap for talented underrepresented students in science technology engineering and mathematics;
- Expose each student to advanced research opportunities and foster relationships with potential employees;
- Grant funding for research and opportunities with the aid of corporate, government, and private partnerships;
- Ignite the pipeline of STEM students with cutting-edge and informative programs; and
- Nutralize myths that "science isn't fun or appealing" and STEM careers are too difficult to achieve.

In the four years since it has been established, the ISC has shown encouraging results in strategically exposing, exciting, promoting, and engaging students about the opportunities and rewards in becoming prominent scientists, technologists, engineers, and mathematicians. The ISC has received support and assistance from various different entities within the government, industry, and academic industries, including the U.S. Navy Naval Air Systems Command (NAVAIR), U.S. Army Research, Development, and Engineering Command (RDECOM), the National Aeronautics and Space Administration (NASA), Lockheed Martin, Northrop Grumman, John Hopkins-Applied Physics Lab (APL), and Innovative STEM Solutions (iSTEMS). The ISC is a three day conference comprised of five major components, the Pre-Conference Day, the Technology Expo, the Maryland-regional Junior Science and Humanities Symposium (MD-

JSHS), the Innovative STEM Symposium (ISS), and the Urban Roundtable for STEM (URSTEM).

Pre-Conference Day

The Pre-Conference Day is the first component of the conference, and it kicks off the rest of the events for the ISC. The target audience for this event is middle school and high school students, specifically those from underrepresented groups, who have either not been fully exposed to STEM or the research environment. The purpose of the Pre-Conference Day is to excite these students about engaging in STEM research, as well as expose these students to STEM in general. The Pre-Conference day features workshops, a middle school STEM competition, and the Technology Expo. The workshops include research writing/design, research topics, and research mentorships, which will help prepare these students in submitting abstracts to the JSHS in the following year. These workshops are conducted by MSU undergraduate and graduate students. The ISC's Technology Expo is full of hands-on exhibits to energize the students and help them make the connection between cutting-edge technology and STEM research and development. The Expo will be further explained later in this paper. The middle school STEM competition is an event during the Pre-Conference day where the middle school students in attendance compete against each other in teams using elements of math, science, engineering, and physical education. Throughout the entire Pre-Conference Day, middle school, high school, and collegiate students, and their parents, are immersed in an exciting and educational STEM research environment. They are also able to interact and engage STEM professionals and educators from the government, private, and academic industries. This day serves as the official kickoff to the ISC, as well as an effective method of recruiting and adding students to the STEM pipeline.

Technology Expo

The Technology Expo is another component of the ISC, and it also occurs on the Pre-Conference Day. This Expo has also proven to be an effective method of attracting and exposing conference participants to the benefits of STEM education. The vendors and exhibitors at the Expo are all instructed to have exhibits that are engaging, hands-on, and alluring. Typically, the Expo has featured over twenty exhibits per year. The Expo serves as a hands-on counterpart to the technical research workshops that the students attend during the Pre-Conference Day.

Maryland-regional Junior Science and Humanities (MD-JSHS)

The JSHS is a regional symposium for high school students (9th-12th), which occurs on the second day of the ISC. All high school students in Maryland are eligible to enter. All high school principals, as well as math and science department heads, are sent an invitation to the conference. Typically, special attention is paid to the schools geographically close to Morgan State University's location in Baltimore, Maryland. The population that these schools serve includes a great number of students from underrepresented groups, including minorities and women. They are sent information about the conference, as well as the submission deadlines for the abstracts. All students are required to submit an abstract online if they desire to present in the JSHS. After the abstracts are submitted, volunteers from the conference's partners serve as reviewers and

assign scores to the submitted abstracts and the final papers, as well. Students are selected to either make an oral presentation or a poster presentation at the JSHS.

Innovative STEM Symposium (ISS)

The ISS is a collegiate symposium that is open to all college students conducting research in the country. It also serves as a complement to the JSHS. Similar to the JSHS, it is an event that allows students to present their original research and receive recognition in a public forum. It also completes the pipeline for ISC, as now the conference serves as an arena for individuals from the 9th grade and above to enter the conference and present their research. Additionally, it helps to track and determine the effect that the conference is having on engaging and motivating students to participate in research as they progress further in their education.

Urban Roundtable for STEM (URSTEM)

The Urban Roundtable for STEM (URSTEM) is the fifth component of the ISC. Accomplished individuals from government, private industry, and academia are invited to participate in and observe the ISC, as well as partake in this roundtable. The objectives of URSTEM is to establish the best possible STEM conference for students in the nation, attract and expose STEM to urban students, and to bridge the gap between STEM and the urban community. Key stakeholders engage in roundtable discussions to suggest and help determine strategies that will be most effective in increasing the numbers of students who enter the STEM pipeline. This roundtable also serves as an opportunity to form partnerships with research labs that can offer research opportunities for students.

Bibliographic Information

1. Matthews, C. Congress Research Service, (2007). *Science, engineering, and mathematics education: status and issues* (Order Code 98-871 STM). Washington, DC: