AC 2008-1614: ATTRACTING MINORITY STUDENTS TO SCIENCE AND ENGINEERING

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Attracting Minority Students to Science and Engineering

Abstract

This paper describes a number of outreach activities to attract minority students to science and engineering careers. These activities include presentations by guest speakers, tours of a NASA center for K-12 educators, workshops for middle school students, and hands-on demonstrations and experiments. The paper presents details about the activities implemented during the last year. Results are briefly described.

Introduction

Strategies employed to recruit and retain students in science and engineering fields include hands-on approaches[1-3], field trips[4, 5], summer workshops[6, 7], competitions[8], and software training programs[9]. This paper describes the activities of a new project, Impact of Space Exploration Programs (ISEP), designed to educate the public about the benefits of space exploration and to attract minority students to science and engineering careers. Specifically, the goals and objectives to be accomplished under ISEP are:

- Increase K-12 educator knowledge of space research projects and educational opportunities
- Inspire students and increase their interest in science, mathematics, and technology
- Increase the public's knowledge of the benefits of space exploration programs
- Communicate to students NASA educational activities and career opportunities
- Enhance the university image in the community and support our efforts in attracting and recruiting Hispanic and other underrepresented students.

These goals are accomplished through the following activities:

- Organizing presentations by NASA guest speakers
- Organizing tours for K-12 educators to visit Johnson Space Center (JSC) and tour center facilities
- Conducting seminars to introduce JSC tour participants to educational opportunities and facilities
- Providing workshops for middle school students where the emphasis is on application of math and science to space related activities especially robots
- Creating a project web site that will serve as a communication link with local constituents and the larger community
- Producing a CD to disseminate the project results and help in sustaining the project.

Student assistants helped with the implementation of all activities, including conducting some of the sessions.

Presentations by Guest Speakers

The presentations by NASA professionals target K-12 educators but are open to others, including the university community, K-12 students, and the general public. Two presentations were organized in 2007. The first presentation, "Space Exploration-An Astronaut's Perspective," was held on November 16, 2006 and was attended by more than 100 people. The guest speaker also visited the Early Child Development Center (ECDC) on November 17 where he talked to students and answered their questions. Fig. 1 shows two pictures taken at these events.

Fig. 1
(a) The audience at the presentation (b) The speaker addressing ECDC students

The second presentation, "NASA Careers and the Future of the Space Program," was held on April 16, 2007. More than 100 people attended this presentation. The speaker also participated in evaluating a presentation on April 17th by students preparing to compete in the "Students Today, NASA Tomorrow" competition. Fig. 2 shows pictures from these events.

Fig. 2
(a) Attendance at the presentation, (b) Students Today NASA Tomorrow presentation

Field Trip to Johnson Space Center

K-12 educators who attend the presentations are recruited to participate in a tour of JSC facilities during the summer. Each tour is limited to 20 participants. If space is available, additional K-12 educators are recruited. The tour consists of a visit to JSC facilities, such as the International Space Station mockups, and includes presentations by the Education Office at JSC. Tour participants are introduced to NASA K-12 faculty educational opportunities, including the following specific programs and facilities:

i. Aerospace Education Services Program Professional Development Workshops (AESP): This program is designed to enhance educator awareness and understanding of scientific research and technological development.

ii. Digital Learning Network (DLN): The DLN provides national standards-based educational modules relating to space exploration through distance learning technology.

iii. Middle School Aerospace Scholars (MAS): MAS is a unique program where teams of middle school teachers from across the State of Texas learn to integrate NASA instructional materials into their own classrooms.

iv. NASA Explorer Schools (NES): This program allows teams from schools to acquire new teaching resources and technology tools using NASA's unique content, experts and other resources to provide exciting learning experiences science, mathematics and technology for students.

v. NASA Quest: This program is an online educational experience allowing students to interact in the classroom with NASA experts, from all fields of work. Activities include background information and curriculum materials.

vi. Space Center Houston - Teacher Camp-ins: This program allows educators to participate in hands-on activities that they can use back in their classrooms while having a great time with fellow teachers.

vii. Space Vehicle Mockup Facility (SVMF): This facility is used to develop, operate, and maintain the mockups to support astronaut training and engineering activities. Mockups include the Space Shuttle Orbiter Trainers and the International Space Station (ISS) Trainer. The purpose of the mockups is to provide flight crew interfaces to train flight crew members, controllers and instructors on the ISS operations, crew systems, maintenance and crew health care.

The summer 2007 tour was conducted on June 15. In addition to the presentations by the education office, participants visited the following facilities: (1) Apollo Era Mission, (2) Operations Control Room, (3) International Space Station Flight Control Room, (4) Space Shuttle Flight Control Room, (5) Space Food Systems Laboratory, (6)

Architecture, Habitation & Integration Facility, and (7) Space Suit Lobby. Fig. 3 shows participants during the tour activities.

Fig. 3
(a) Listening to a presentation in a control room, (b) A group picture

Middle School Students Lego Workshop

A workshop for students from middle schools is conducted during the summer. The workshop consists of two afternoons. On the first day, students are exposed to robots and their applications and learn how to build a simple robot and program it. On the second day, students create their own robot and identify future robot applications. The Mindstorm kits enable students to learn math and engineering concepts and combine robotics, sensors, controllers, motors, and standard LEGO parts to design, assemble, and program real robots that move, act, and think on their own. The summer 2007 workshop was held on June 12 and 14, 2007, from 1 pm to 5 pm. Around 30 students in grades 6, 7, and 8 participated in this workshop. Fig. 4 shows a team of students assembling their robot.

Fig. 4
(a) Students constructing their robot, (b) completed robot

Careers in Science Presentations and Demonstrations

Three presentations with demonstrations in the engineering technology labs were given on May 11th, 14th, and 21st, 2007 to students from three different schools. Each presentation involved introducing a number of engineering aspects. One of the presentations was on the aero dynamics of building a paper airplane. Introducing the various concepts that could affect the flight of an aircraft, comparing the different designs of aircraft and the building paper airplanes and choosing which design would have the best chance of flying well and having stability in flight. Another presentation covered the Remotely Operated Vehicle (ROV), a project sponsored by NASA. The presentation described the instrumentation and mechanical aspects of the ROV. A video of the ROV operating in the bay was displayed with explanation of the different equipment that the craft contains and their function. An explanation was given about the various changes that have been made to the craft since its initial design over two years ago and the attempts to make the craft a better functioning data recording platform. A third short presentation on the formula SAE car, explaining that every item on the car had to be designed on fabricated by students. Fig. 5 shows two groups of students listing to presenters in the lab and examining the projects.

Fig. 5
(a) Students inspecting the SAE car, (b) Students learning about the ROV

Youth Outreach Session

On June 18, 2007, an afternoon workshop was conducted to introduce participants in a youth outreach program to electrical engineering. Students performed two simple experiments using a variety of lab instruments and tools. The first experiment illustrates how a lamp can be turned on and off as shown in Fig. 6. A 9V battery provides the electricity that lights up the lamp. Switches are used to turn the LED (lamp) ON and OFF. Students are asked to notice the plus and minus signs next to the LED. The LED has a plus side and a minus side. The plus and minus sides have to be placed in the circuit as shown in the diagram above. To avoid delays in constructing the circuit, students are also given a diagram showing the actual connections on a breadboard.

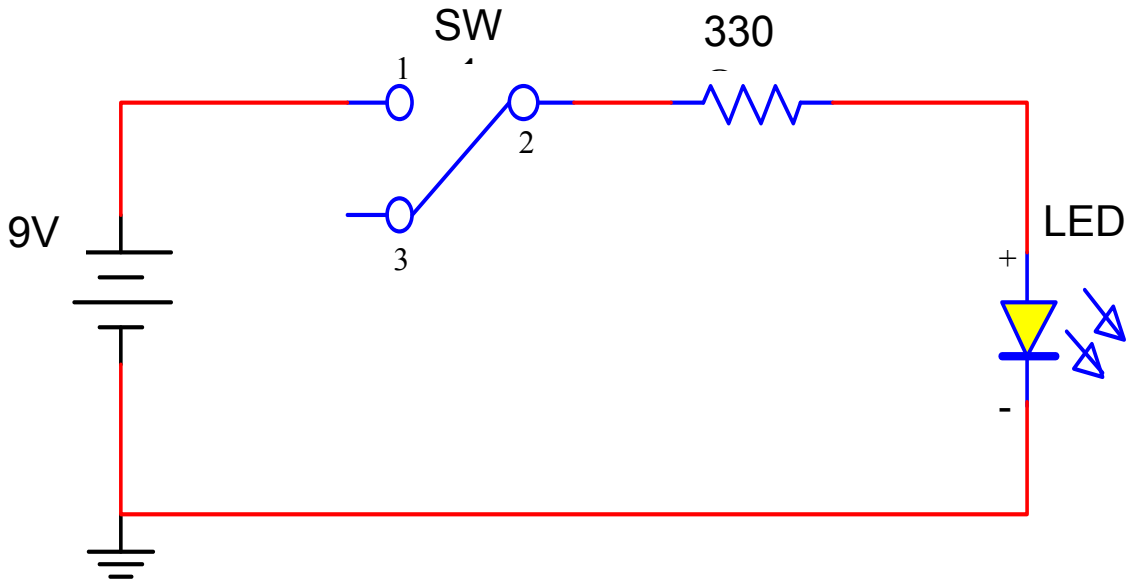

Fig. 6 A simple electric circuit

The second experiment uses two 3-way switches. The "3-way" switch circuit is usually found in homes and offices that have more than one switch to turn on the lights. The LED may be turned ON or OFF from two different locations. Students were asked to design this circuit on their own. This was a challenging exercise that several students were able to figure out without any help from the instructor. The drawing in Fig. 7 shows the complete circuit. Fig. 8 shows a team of students as they construct their circuit.

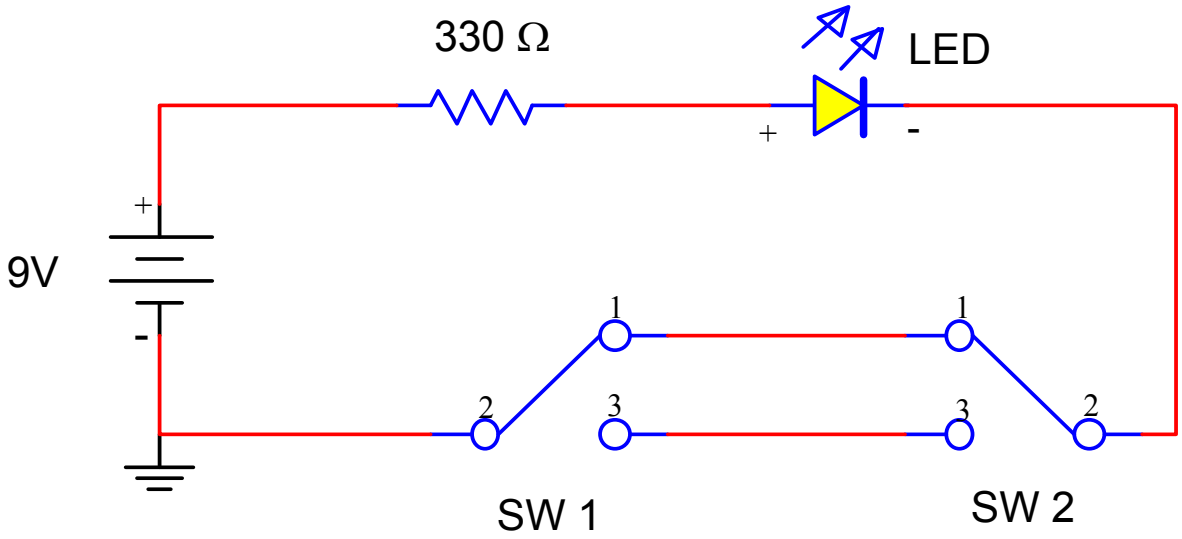

Fig. 7 A circuit using 3-way switches

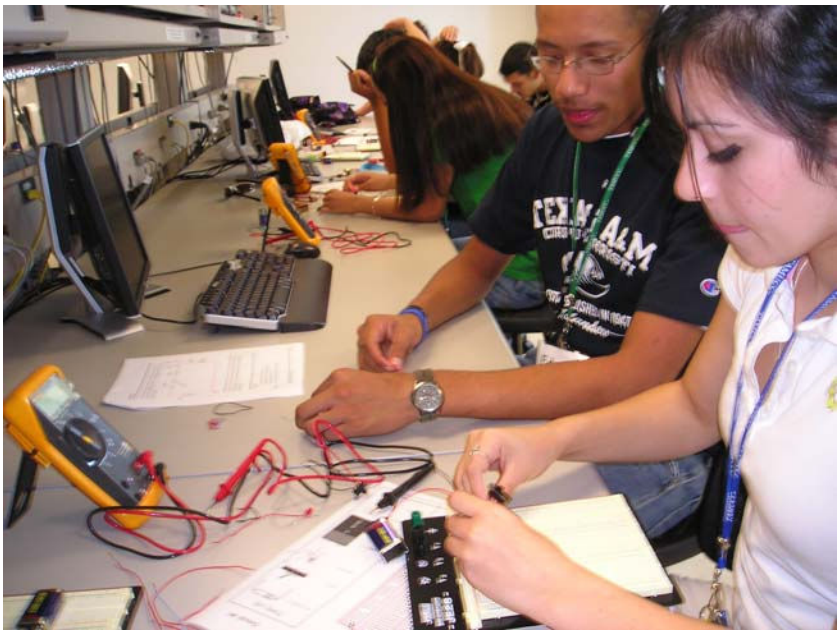

Fig. 8 Teams of students constructing their circuits on breadboards

Conclusion

This paper described several recruitment and outreach activities to attract students to science and engineering careers. More than 350 individuals participated in these activities during the 2006-2007 school year. Although formal evaluation was not conducted, the feedback from the different groups was very positive and encouraging.

Acknowledgement

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