Target Audience

The target audiences of the project are pre-college students, i.e. middle school students, particularly those whom are members of underrepresented groups. The direct participants consisted of one 7th grade classroom composed of 20 students, 55% of whom were females and 90% belonged to underrepresented groups.

Major Tasks of the Project

The goals of the project are to promote interest in the discipline of engineering sciences among middle school students while simultaneously fulfilling specific national and state standards. According to a pre-lesson survey, 70% of the direct participants did not have any desire to become future scientists and engineers and 40% of the students showed a complete lack of interests in science and engineering. To maintain a competitive edge in our global economy and to address the increasing numbers of global issues, promoting youth’s interest in science and engineering and sustaining the effort are crucial. To achieve these goals, the following tasks were proposed:

1. Recruit one teacher partner and two undergraduate students
2. Develop and test three modules of inquiry-driven, problem based educational materials, in collaboration with the teacher partner and the undergraduate students
3. Refine educational materials
4. Implement educational materials in the 7th grade classroom
5. Assess the direct participants’ interests via pre/post-lesson surveys to determine effectiveness
6. Refine methodology and develop additional materials for other grade levels
7. Broaden the impacts of the project with local school board presentations

Task Schedule

Within the pre-existing fellowship period, the following short-term goals were achieved:

- One teacher partner and two undergraduate students were recruited at the start of the project.
- Three modules of educational materials were developed, tested, and refined over a 4 month period.
• Educational materials were implemented in a 7th grade classroom and the participants' interests in science and engineering were assessed over a 2 day period.
• Impacts of the outreach effort were assessed during the remainder of the fellowship period.

The following longer term goals are desired:

• Refine methodology and develop materials for 8th grade classrooms over a 4 month period.
• Implement educational materials in 8th grade classrooms over a 3-5 day period.

Technical Approach

Based on the pre-lesson surveys, students indicated lack of interests in science and engineering for the following reasons:

• Students did not regard science and engineering as being useful subjects.
• Students did not have a clear idea of what a job as a scientist or an engineer entailed.
• Students were not interested in how science content was delivered in their classroom.

The technical approach of the project was aimed at addressing these reasons. The following educational objectives resulted:

• Introduced the work of NASA scientists and engineers through the module Chemical engineers and carbon dioxide.
• Demonstrated how the skills utilized in science and engineering problem solving can be applied in real-world challenges through the following modules:
  o Chemical engineers and carbon dioxide – an opportunity to share my research expertise was also incorporated into this module
  o Civil engineers and structural support
  o Materials engineers and memory alloys
• Accomplish the two educational objectives listed above through exciting and mind-provoking activities which simultaneously fulfilled the following national and state standards:
  o History and nature of Science (NS.5-8.7, 7th and 8th Grade – Strand 2)
  o Science and Technology (NS.5-8.5, 7th and 8th Grade – Strand 3)
  o Science in personal and social perspectives (NS.5-8.6, 7th and 8th Grade – Strand 3)
  o Science as inquiry (NS.5-8.1, 7th and 8th Grade – Strand 1)
  o Physical Science (NS.5-8.2, 8th Grade – Strand 5)
  o Earth and Space Science (NS.5-8.4, 7th Grade – Strand 6, Concept 3)
Evaluation and Outcome

Surveys were utilized to evaluate the effectiveness of the project. Twenty students, 1 teacher, and 2 undergraduate students were directly impacted by the project. Pre- and post-lesson surveys were administered to students to determine if the project effectively impacted their interest in science and engineering. According to post-lesson surveys, 50% of the direct participants indicated interests in becoming a scientist or an engineer, an increase of 20% over the value identified via the pre-lesson surveys. Students were also asked to assign a numerical value to represent their level of interest in science and engineering, i.e. 1 = not interested, 5 = very interested. Eighty five percent (85%) of the students expressed an increase in interests, i.e. assigned a higher numerical value to represent their level of interest in their post-lesson surveys as compared to their pre-lesson surveys, in science and engineering.

Sustainability and Long range impact

Two undergraduate students, civil engineering student Leon Begay and materials science and engineering student Nathan Cernatic, were recruited for the sustainability of the project. The goal in this sustainability plan is to promote the undergraduate students’ interests in sustaining outreach efforts in their graduate studies or as professionals in the future for long range impacts. A questionnaire was administered to the undergraduate students subsequent to their involvements in lesson planning and lesson implementation to evaluate the effectiveness of the sustainability plan. Based on their responses in the questionnaires, the undergraduate students felt they gained “a great experience... practicing their [communication] skills” and stated their desire to participate and lead similar outreach activities in the future.

Other long range impacts are anticipated to result from further support by NASA. Specifically, the collaborating teacher partner has indicated interests in modifying and implementing the developed educational materials in three 8th grade classrooms. Other teachers at the participating school can also benefit from educational materials adaptable to their grade levels.