

Project: Mission to Outer Space: The Planet Exploration Rover Chronicles
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Project Website: <http://edweb.sdsu.edu/i2techscie>

Project Categories: Programs, Curriculum Development, Research

Primary Target: Youth (Middle)

How to Reach Primary Target: Workshops for teachers and students and WebQuest

Secondary Target:

How to Reach Secondary Target: Workshops for teacher/program workers and students and WebQuest

General Demographics: upper and middle school students from urban and culturally diverse schools

Project Dates: 7/1/2007 - 7/1/2008

Evaluation Strategy: Surveys and group interviews of participants

Project Descriptions

Summary: In this inquiry-based after school science program, students are provided with multiple opportunities to act like scientists in a problem-solving scenario. In other words, students were involved in planning and building a model of a planet exploration rover to investigate an unknown solar body onto which they have “crashed landed.” Probeware, wireless video cameras, and other devices were part of the students’ designs, and were mounted to the students’ rovers. A small model of the unknown planet landscape was built, and students were required to use the knowledge they have acquired during the after school program, and their rovers to identify the unknown planet and interpret data gathered by the probes. To make the activity more challenging and realistic, students are allowed to maneuver their rovers by remote control using only the image sent via an on-board wireless camera and the data from the probes. We believe that this kind of authentic, hands-on, minds-on and focused curriculum unit promotes a deeper understanding of science than traditional teaching strategies while encouraging creativity and interest among all students. These carefully designed activities are not only aligned with the National Science Education Standards, they are also meant to highlight some underemphasized strengths of NASA scientists like teamwork, independence, creativity, problem solving,

brain storming and collaboration. The integration of learning technologies with science content are further implemented in these activities by using a specially designed WebQuest that guides the students (and the program providers) in regard to all aspects of the project. The WebQuest program is essentially divided into two curriculum parts. In the first part, students are required to work as a team of scientists and astronauts who come together to prepare a proposal to NASA for the construction of a planetary exploration rover. They can pick the planet or solar object of their choice, but in order to prepare a successful proposal they must do research on the most current information about their chosen solar object. In the second part, the scientists and astronauts' spaceship is lost in space, so they must use their rover to explore a nearby solar object in order to call home. Of course this part can only be completed if a model of a rover is built. We will provide more information on how to acquire the various components for building the rover, as well as information on the probeware.

Impact: Data from students' interviews and surveys strongly indicate that participating upper elementary and middle school students have found this program to be very engaging, challenging and rewarding as they not only learn about science concepts and the authentic work of scientists, but also about themselves and their abilities to work as a team. Students' comments reflect a realization that just as in the real world of practicing scientists, no one person is the sole expert on everything. The program is also meant to be more culturally and socially relevant by encouraging students to discuss in authentic ways the costs and benefits for space exploration. Also, with different students responsible for different aspects of designing, building, and navigating students learned in the spirit of collaboration to value one another's contributions as they worked together through a challenging task. Like NASA's "Spirit" and "Opportunity" children were asked to name their rovers. To value children's own background and experiences in the classroom, they were encouraged to bring aspects of their culture into the design of the rover. For example, some students created an emblem or flag that represented the cultures of those who participated in the rover design. Others chose to take key items that represented who they were culturally on their mission. These types of activities provided multiple entry points for students (and the instructors) to get know each other and to make the science content more culturally relevant to all participants. The WebQuest associated with this project provides more examples of how the students' cultural backgrounds and interests can be integrated in this science activity (see WebQuest info. below). This program was part of a larger professional development research project, Integrating Instructional Technologies with Science Education (I2TechSciE), sponsored by the National Science Foundation (NSF Grant

#0306156).

Lessons:

Focused and authentic problem-solving scenarios like the one described here can provide multiple opportunities for hands-on and minds activities that teachers in a regular classrooms do not have the time (or support) to offer. The standards based curriculum unit described in this paper also illustrates how learning technologies, complex science content knowledge and inquiry-based pedagogy could be integrated to make science more culturally relevant and engaging to all students. It is this kind of integration that helps make science more appealing to students and that may ultimately encourage them to pursue STEM-related careers.